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Chapter III



OCEANOGRAPHY; COASTAL HYDROG-
RAPHY; COASTS; AND LANDING PLACES

OF

BULGARIA

(JANIS No. 38)



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Chapter III

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OCEANOGRAPHY, COASTAL HYDROGRAPHY, COASTS, LANDING PLACES

30. General Description.

A. Tides and currents.

Tides and tidal currents in the Black Sea are negligible, but sudden changes in barometric pressure or offshore winds may cause the sea level to vary two or three feet. From five to ten miles offshore a southerly current sets at one-half to one knot.

B. Seas and swells.

Since uncertain and variable winds are characteristic of the western Black Sea, the intensity and duration of the seas and swells may change rapidly with the wind.

(1) *Seas.* Such rough seas as occur usually approach the Bulgarian coast from the northeast. The waves are short, steep and of short period. High seas are most frequent from October through April and least frequent in May and June. Throughout the year calm or slight surf may be expected along the coast at least 20 days each month.

(2) *Swells.* During the summer, swells three to six feet high occur about five per cent of the time, while in winter they occur about 10 to 20 per cent of the time.

C. Fogs.

Along the Bulgarian coast, fogs are least frequent in summer though occasional "white fogs" appear or disperse rapidly during calms. Fogs are most frequent in spring.

D. Hydrographic factors.

The surface of the Black Sea is nowhere more than half as salty as the open ocean. However, density gradients due to temperature and salinity stratification are of importance to submarine operations. Good conditions for echo ranging by surface vessels on submarines prevail during the winter, but conditions become progressively poorer during the late spring, and are bad in early summer. The water of the Black Sea is probably never very clear, but luminescence (phosphorescence) is common. Electrical conductivity varies from 0.013 to 0.032 reciprocal ohms per cubic centimeter.

E. Bottom.

Along the open coast, the bottom out to depths of 30 or 40 fathoms is *sand*, and *mud and sand*. The Gulf of Burgaz (Burghaz) and Varna Bay are the most probable, if not the only feasible, locations for mining and counter-mining.

F. Fishing areas.

The chief marine fishing areas are in the bays and harbors and within one and one-half miles of the shore on the open coast. Fish weirs are set close to the headlands of harbors but, to avoid the strongest currents, are not set directly on the tips of the promontories.

*See Appendix I for all spellings of features. Cities and towns mentioned in this Chapter are spelled in accordance with G.S., G.S. maps, 1:250,000, Series #4088 or G.S., G.S. maps, 1:500,000, Series #4072, where the former does not cover. The names of other maritime features are spelled in accordance with B.A. and H.O. charts. Variants follow in parentheses.

G. Coastal hydrography.

The 30-fathom curve lies at a distance of about 18 miles off the coast of Bulgaria. The 20-fathom curve is about one mile from the southern shore. Off the Gulf of Burgaz, this curve is near a line joining the two entrance points (Baghlar Point and Cape Emine). North of the Gulf, the 20-fathom curve swings away from shore, increasing from one and one-half miles off Cape Emine to 15 miles offshore at Batova Bay.

North of Cape Emine the ten-fathom curve lies about 750 yards from shore, where the bottom is evenly sloping. Off Varna Bay this curve is near the line joining the two entrance points (Cape Galata and Cape Sveti Georgii). North of this latter cape, the five-fathom curve is about 750 yards from the shore, which is here fringed by a bank extending from Monastary (Chingani) Reef to Balcic (Baljic).

H. Coasts.

The coastal frontage of Bulgaria on the Black Sea is only 79 nautical miles, measured in a straight line from the southern to the northern boundary of the country. By following the shore-line with a measuring unit of one nautical mile, the length of the coast is found to be 117 nautical miles, though the actual length is, of course, somewhat greater.

The coast, in general, is moderately high and backed by mountains. It is fringed with a narrow strip of stony beach behind which rise abrupt cliffs or hills, usually covered with a thick growth of bushes. The shore is marshy in a few places but sandy beaches are comparatively rare. The only important indentations are Gulf of Burgaz and Varna Bay. At the head of each of these is located the port of the same name.

The Gulf of Burgaz, situated about midway along the coast, has a width of 23 miles between its entrance points and a horizontal depth of 17 miles. The smaller Varna Bay, near the northern boundary, has an entrance width of four miles and a horizontal depth of three miles, or, if Lake Devna (Devno), which is connected by a canal to the head of the bay, be included, the depth is nine miles. This lake is actually the estuary of the Devna River, which is one of the two streams of any importance along the Bulgarian coast, the other being the Kamchiya River, flowing into the sea about ten miles south of Cape Galata.

From the southern boundary, near Cape Stefano, the coast runs northwesterly as far as Burgaz Bay and is hilly and wild, with several crescent-shaped coves in which small vessels may find anchorage. Small streams, perhaps dry at times, flow into most of these coves, but there are no rivers of any size.

The south shore of Burgaz Bay has three hilly, wooded peninsulas jutting out to the north. The western shore of the bay, south of the city of Burgaz, is low and sandy and covered with reeds. It extends to the northward as far as the base of the high land on which the city of Burgaz stands. This low shore separates the bay from a lagoon, which is about five miles long from west to east and two miles wide. The beach is only 200 yards wide at the northern end. There

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are bathing beaches along the east side of the city, but behind these beaches is a high bluff.

Immediately north of the city of Burgaz is a narrow strip of marshy land separating the bay from a second lagoon. Beyond this lagoon cliffs rise abruptly from the water's edge and extend almost as far as Nesebr (Messemvria). This latter town stands on a rocky peninsula and is connected to the mainland by a narrow isthmus of sand which is sometimes covered by the sea. To the south and north of Nesebr there are sandy beaches, and the beach to the north is backed by a marsh about three miles in length, covered with high reeds.

A short distance north of Nesebr the coast bends abruptly to the eastward and continues in a straight line for nearly eight miles to Cape Emine. This shore is very hilly and Cape Emine itself is a bold headland. North of the cape the coast has a northerly trend and is comparatively straight, with few indentations. It is backed by high hills, between which small streams wind their way to the shore. About ten miles south of Cape Galata is the mouth of the Kamchiya River, an important stream, flowing along the northern edge of a broad, marshy, densely wooded plain which here breaks through the hills and white cliffs.

From the Kamchiya River to Cape Galata the coast runs slightly to the east of north and is very hilly. At Cape Galata it turns to the west to form Varna Bay, the south shore of which is also hilly. The western shore of the bay, south of the city of Varna, is low and marshy and consists of a neck of land which separates the bay on the east from Lake Devna on the west.

Along the east side of the city of Varna are bathing beaches, behind which are buildings, presumably bath houses, and above these a park rises steeply in terraces. To the north of the beaches there is a cemetery and beyond this the coast is lined with cliffs as far as Evksinograd Bay. These cliffs are between 60 and 70 feet high from Varna to a point midway between Varna and Evksinograd Bay, and between 100 and 130 feet for the remainder of the distance.

Hills and cliffs continue along the coast north of Evksinograd as far as Batova Bay, which lies off a thickly wooded and swampy plain. North of this plain, cliffs backed by hills, line the shore to Balic and beyond.

31. Oceanography

A. Tides.

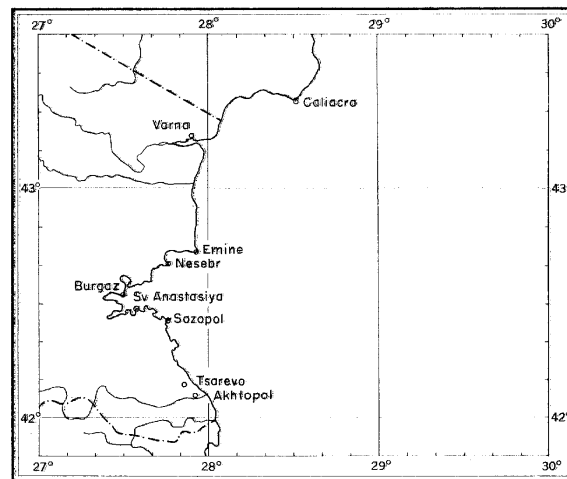
(1) *Tidal range.* The tide in the Black Sea is very small, the range in the western part being less than three inches on the average and only about four inches at springs. On the coast of Bulgaria, this small tide is masked by the larger variations in level due to meteorological conditions and may be disregarded for all practical purposes.

(2) *Non-periodic changes in sea level.*

(a) *Changes due to wind and barometric pressure.* A wind from the sea raises the level and a wind from the land lowers it. Occasionally at Varna (Figure III - 1) the wind may change the level by two feet, but with unusual conditions even larger variations have occurred. In general, the range of oscillations is greater in autumn and winter (November to January) than in summer (June, July). During the 20-year period ending in 1914, the variation between the highest and lowest levels observed at Varna amounted to three and one-half feet.

A larger variation occurred on the Bulgarian coast south of Cape Emine on January 25, 1921 when, due to an atmospheric low pressure area which moved eastward across Bulgaria, the sea fell and rose several times, one rise amounting to slightly more than four feet in one and one-half hours. The barometer rose 0.9 inch in the 34 hours from 2100 January 24 to 0700 January 26. West and northwest winds were very strong following the depression. At the beach of Nesebr, a strip of shore 160 feet broad was exposed; at Pomoriye

FIGURE III - 1



BULGARIA. Location of major places mentioned in Topic No. 31.

the water fell about three feet and receded about 30 feet from shore. At Sozopol the drop was more than three feet and the recession was 50 feet leaving the piers dry. At Burgaz the water level, on January 25, first dropped 80 cm. (2.6 feet) from 0600 to 0845, after which it rose 125 cm. (4.1 feet) in the next one and one-half hours. In the following one and one-half hours it fell 115 cm. (3.8 feet). Succeeding oscillations became progressively smaller.

(b) *Seasonal changes.* Because of the seasonal influx from the rivers, the level of the Black Sea undergoes a seasonal variation of one-half foot to one foot, reaching its maximum height in May to July and minimum in October to December. Usually from April to August, inclusive, the level is higher than the mean for the year and from September to March it is lower, the rise being most marked from April to May, and the fall from August to September.

(c) *Annual changes.* From year to year the mean annual sea level fluctuates over the very small range of about 2.2 inches.

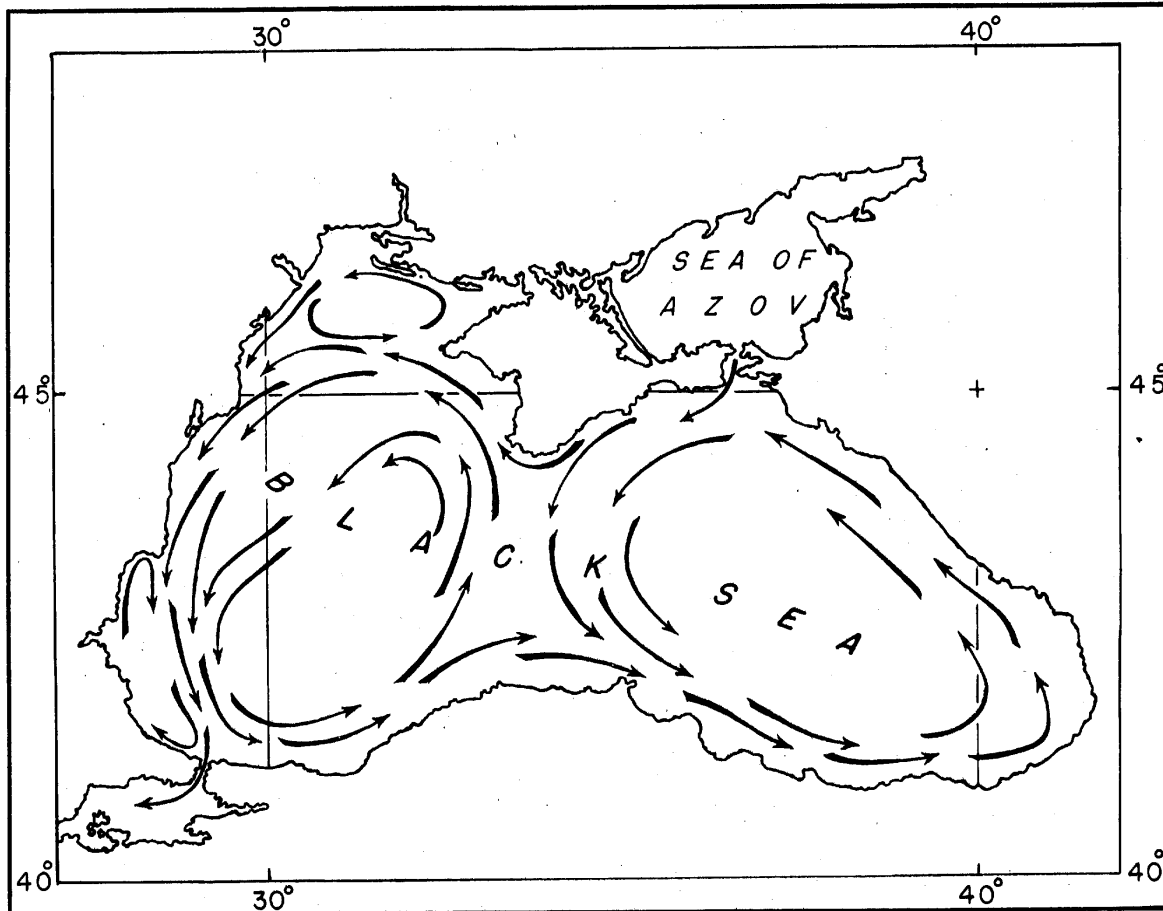
B. Tidal currents.

Like the tide, the tidal currents along the coast of Bulgaria are negligible.

C. Non-tidal currents.

(1) *Average direction.* The general circulation of the Black Sea consists of two counter-clockwise currents, one in the eastern basin, the other in the western (Fig. III - 2). The latter is known as the "Devil" as it flows past the coast of

FIGURE III - 2



General non-tidal currents in the Black Sea.

Bulgaria in a southerly direction, some five to ten miles off-shore, with a width of roughly six to ten miles, and with a depth of 19 fathoms. Below this depth little current is to be expected.

(2) *Velocity.* The usual velocity of the current is 0.5 knot. This value may be increased to slightly over one knot by northerly winds or during the period of run-off of the spring floods in the large rivers in the northern portion of the Black Sea.

(3) *Effect of wind from different directions.* Winds exert a considerable influence on the direction as well as the velocity of the current. On a passage from Burgaz to Istanbul, it has been reported "that with a moderate gale from north-north-east, an unmistakable set on to the coast and to the southward was experienced, amounting at first to only one-half knot, but getting stronger as the wind increased," this current "was such as might have caused the loss of vessels had the lights not been seen. With calms and light southerly winds, no current was experienced, which appears to point to the fact that the currents are greatly influenced by the prevailing wind."

Between the coast and the current of the Devil, there is apparently at times, a northerly set of about 0.3 to 0.5 knot as far north as the Gulf of Cavarna (Figure III - 2). In all

probability this is to be expected with a wind of several days' duration from a southerly direction.

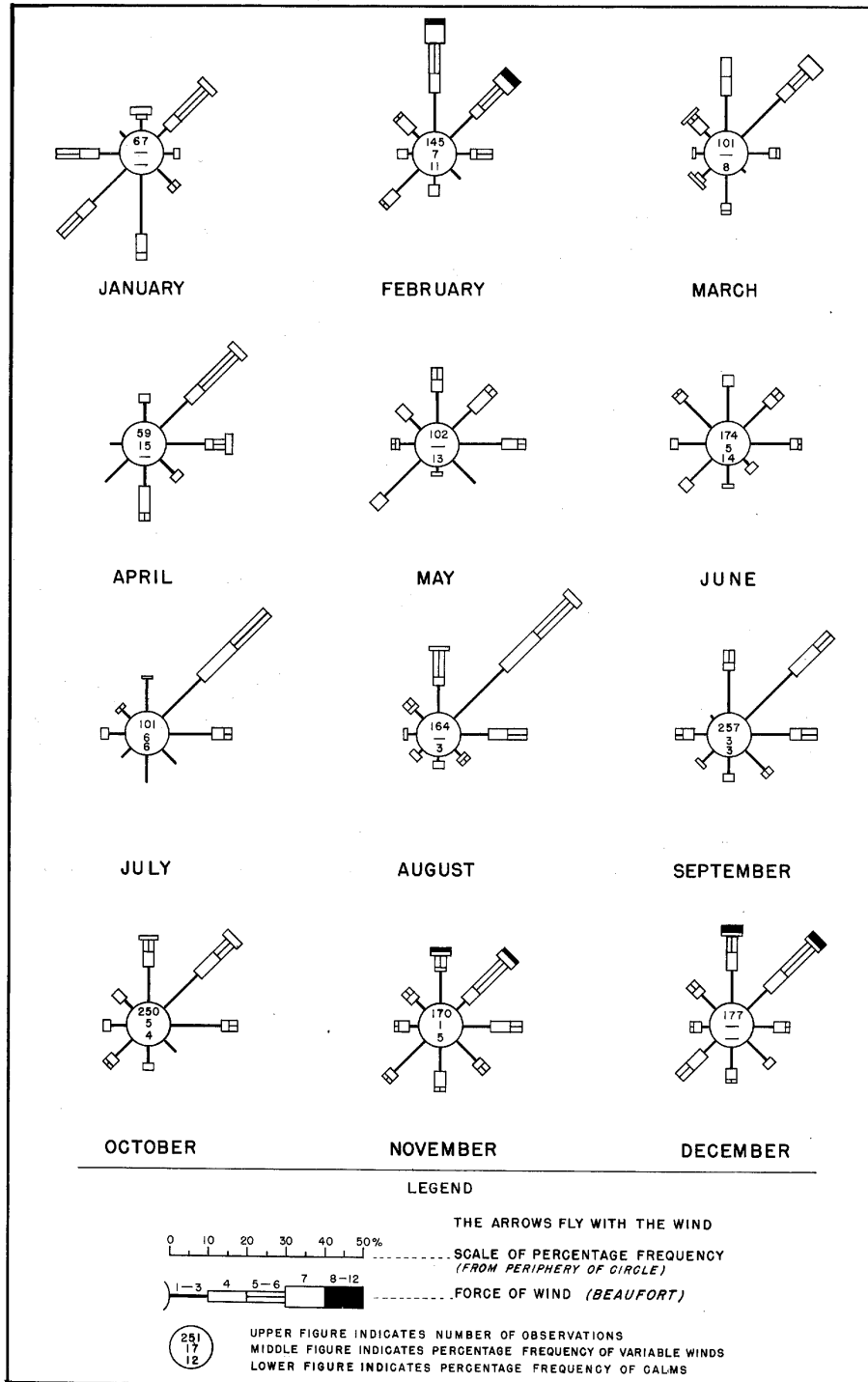
(4) *Currents in Gulf of Varna.* It is likely that a small counter-clockwise eddy exists within the Gulf of Varna. Thus, organic debris from the slaughterhouse on the western shore is carried along the southern coast, resulting in an unusually luxuriant bed of eel-grass which extends toward Galata, the easternmost point on the southern shore (Figure III - 14).

D. Sea and swell.

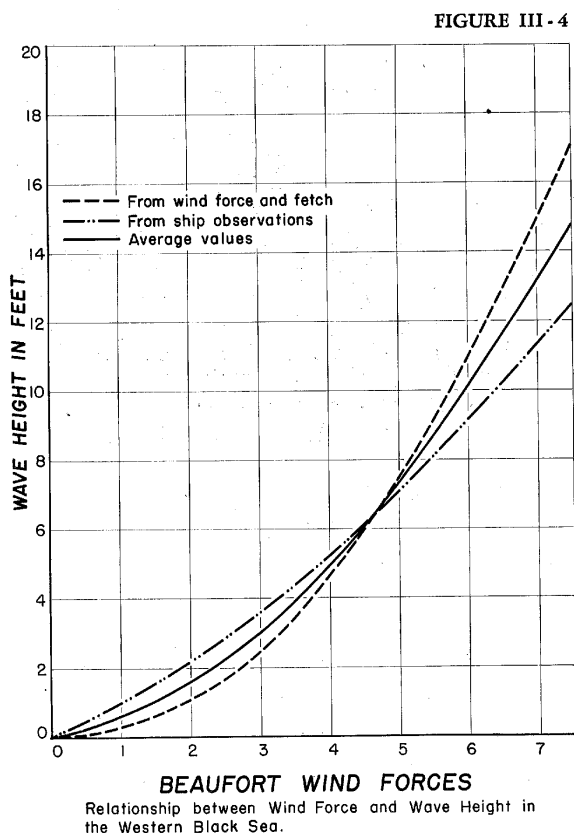
(1) *Character.* Empirical data on surf conditions along the Bulgarian coast are not available. Consequently, the character of surf on different beaches must be estimated from a knowledge of variations in sea state and swell on the open sea combined with information concerning the configuration of the coast, the slope of the bottom near the coast and the orientation of the coast line relative to the direction from which the waves come.

The amount of sea, that is the height and character of waves in the open sea caused by local winds, depends mainly upon wind velocity, the length of time the wind has been blowing and the area of open sea over which it has blown

FIGURE III - 3



WIND ROSES FOR THE BLACK SEA AREA WEST OF 30° EAST LONGITUDE



(fetch). The swell represents the waves caused by past winds or winds at a distance.

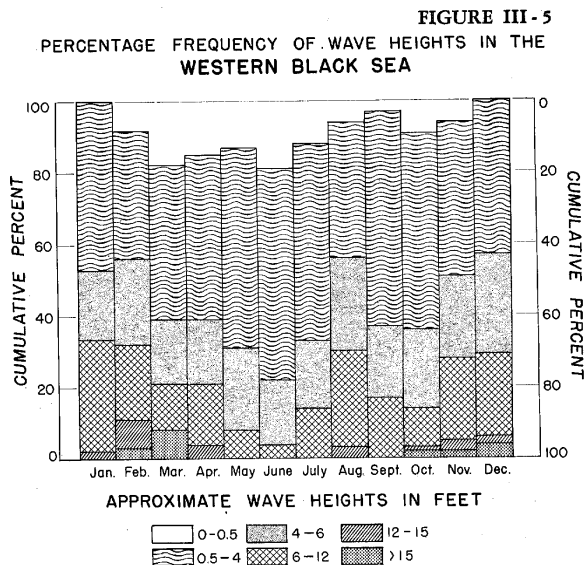
(2) *Relationship between wind force and sea state.* A definite average relationship exists between wind force and sea state in the Black Sea. For the Bulgarian coast, this relationship as shown by the solid line in Figure III - 4, is the mean of values of wave heights obtained (1) by calculation from wind data assuming a fetch of 100 miles for winds from N through W to SE, and a fetch of 200 miles for winds from NE and E, and (2) by analysis of ship observations of concurrent wind and sea. Table III - 1 gives the average wave height values, the approximate wave height limits for each wind force as shown by Figure III - 4, and the estimated length, period and velocity for waves of these average heights. It is evident that short, steep waves of short period are characteristic of the western Black Sea.

TABLE III - 1
RELATIONSHIP BETWEEN WIND FORCE AND WAVE
HEIGHT IN THE WESTERN BLACK SEA, AND
APPROXIMATE WAVE CHARACTERISTICS

WINDS BEAUFORT FORCE	WAVE HEIGHTS AVERAGE (FEET)	LIMITS (FEET)	LENGTH (FEET)	PERIOD (SECONDS)	VELOCITY (KNOTS)
1-3	2	0.5-4	20	2	6
4	5	4-6	80	4	12
5, 6	9	6-12	180	6	18
7	13	12-15	260	7	21
>7	>15*		>300	>8	>24

* Estimated from wind data only.

(3) *Percentage frequency of different states of sea by months.* Application of these average wave heights to the percentage frequencies of the various wind forces shown in Figure III - 3 gives the frequencies of wave heights by months indicated in Figure III - 5.



(4) *Sea direction.* Because of the configuration of the Bulgarian coastline, only NE, E, and SE winds are likely to cause troublesome seas near the shore. Consequently, the percentage frequency for each month of these winds in the open sea—a good indication of waves from these directions—and the average wave heights which may be expected to accompany them are shown in Table III - 2. The table shows clearly that rough and high seas may be expected to approach the shore predominantly from the northeast.

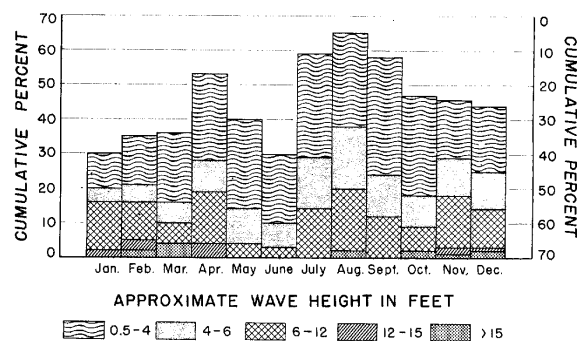
TABLE III - 2
PERCENTAGE FREQUENCIES OF WIND FORCES
AND ESTIMATED AVERAGE WAVE HEIGHTS
IN FEET FROM NE., E., AND SE.

WAVE HEIGHTS WIND FORCE	0.5-4 1-3	4-6 4	6-12 5, 6	12-15 7	>15 8-12	SUMS
JANUARY						
NE.....	3	4	10	2	—	19
E.....	2	—	2	—	—	4
SE.....	5	—	2	—	—	7
SUMS.....	10	4	14	2	—	30
FEBRUARY						
NE.....	8	3	7	3	2	23
E.....	3	2	4	—	—	9
SE.....	3	—	—	—	—	3
SUMS.....	14	5	11	3	2	35
MARCH						
NE.....	14	4	5	—	4	27
E.....	5	2	1	—	—	8
SE.....	1	—	—	—	—	1
SUMS.....	20	6	6	—	4	36

WAVE HEIGHTS WIND FORCE	0.5-4 1-3	4-6 4	6-12 5, 6	12-15 7	>15 8-12	SUMS
APRIL						
NE.....	10	5	12	2	—	29
E.....	10	2	3	2	—	17
SE.....	5	2	—	—	—	7
SUMS.....	25	9	15	4	—	53
MAY						
NE.....	7	6	2	—	—	15
E.....	11	4	2	—	—	17
SE.....	8	—	—	—	—	8
SUMS.....	26	10	4	—	—	40
JUNE						
NE.....	8	3	2	—	—	13
E.....	10	2	1	—	—	13
SE.....	2	2	—	—	—	4
SUMS.....	20	7	3	—	—	30
JULY						
NE.....	14	12	12	—	—	38
E.....	11	3	2	—	—	16
SE.....	5	—	—	—	—	5
SUMS.....	30	15	14	—	—	59
AUGUST						
NE.....	18	12	12	—	2	44
E.....	7	5	5	—	—	17
SE.....	2	1	1	—	—	4
SUMS.....	27	18	18	—	2	65
SEPTEMBER						
NE.....	17	9	6	—	—	32
E.....	10	3	4	—	—	17
SE.....	7	—	2	—	—	9
SUMS.....	34	12	12	—	—	58
OCTOBER						
NE.....	12	7	5	—	2	26
E.....	13	2	2	—	—	17
SE.....	4	—	—	—	—	5
SUMS.....	29	9	7	—	2	47
NOVEMBER						
NE.....	3	4	10	2	1	20
E.....	7	5	3	—	—	15
SE.....	7	2	2	—	—	11
SUMS.....	17	11	15	2	1	46
DECEMBER						
NE.....	7	6	10	1	2	26
E.....	5	3	1	—	—	9
SE.....	7	2	—	—	—	9
SUMS.....	19	11	11	1	2	44

FIGURE III - 6

THE PERCENTAGE OF VARIOUS STATES OF SEA ALONG THE BULGARIAN COAST

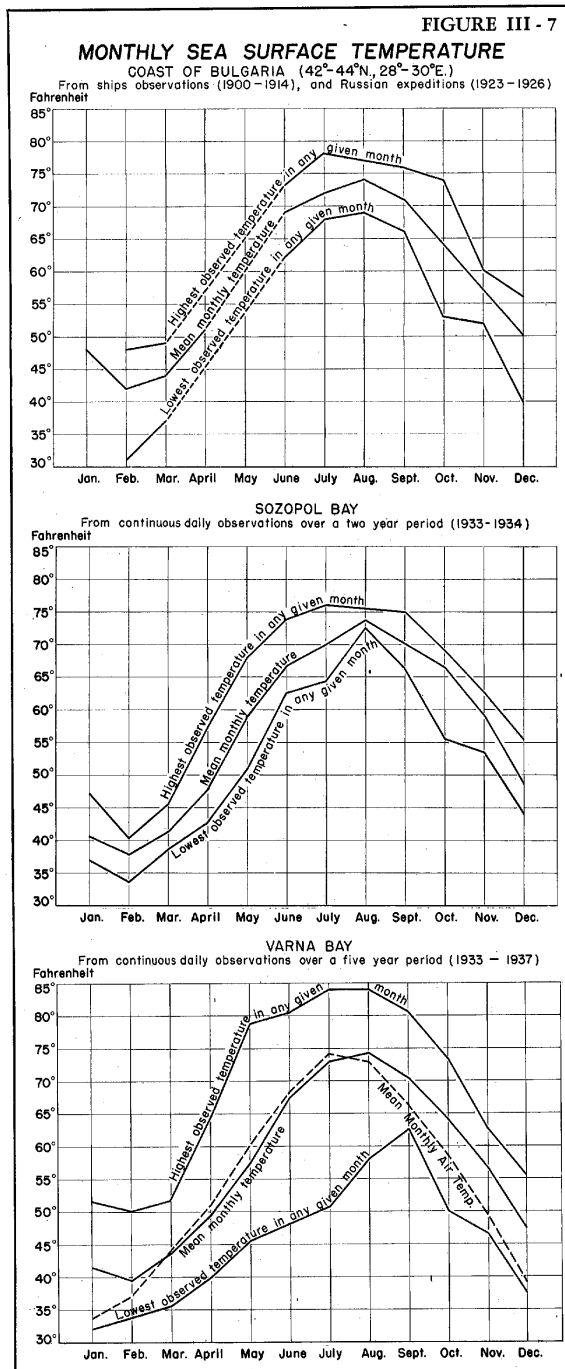


The monthly sums of the table are represented in Figure III - 6 which shows that *at the coast* throughout the year calm or slight surf may be expected to occur on at least twenty days in each month, rough seas are least frequent during May and June, and high seas are limited almost entirely from October through April.

Along the coast, easterly onshore breezes (not shown in Table III - 2) prevail during spring and summer afternoons. These give rise to slight seas from the east near shore.

(5) *Frequency and character of swell.* Ship's observations for March and wind data for several other months indicate that NE swells three to six feet high occur about five per cent of the time during the summer months and ten to 20 per cent of the time during the winter. These swells will have a period of about six seconds and a wave length of 200 feet or less. In November, an easterly swell six to ten or more feet in height may be present ten per cent of the time, due to strong easterly winds in the eastern half of the Black Sea. The wave length of this easterly swell will be from 100 to 200 yards and the period from eight to 12 seconds.

(6) *Duration and occurrence of sea and swell.* Uncertain and variable winds are characteristic of the western Black Sea; the character of the sea and the swell thus change rapidly in intensity and duration with the changing winds. From October to April atmospheric low pressure areas frequently pass eastward across the sea. These are preceded by strong southerly or southeasterly winds, sometimes reaching gale force, but usually of short duration, which create a short, troublesome sea. In the rear of these depressions strong winds set in from the northwest. These are likely to shift to the northeast. The shift of wind is usually heralded by a swell from the northeast. After the passage of the depression, the northeast wind may blow strong for two or three days with an accompanying persistent heavy sea. The infrequent passage of low pressure areas in summer does not usually result in strong, persistent winds but rather in thunderstorms and local squalls which give rise to short, choppy seas. In late summer during about three days in each month the prevailing northeasterly winds increase to force five or six with an accompanying rise in the sea state. As shown in Table III - 2, however, wind forces greater than six and wave heights greater than 12 feet only rarely occur in summer.



E. General discussion of hydrographic factors.

(1) *Application of temperature and salinity data.* Surface and subsurface temperature and salinity gradients in the open sea determine the paths of sound rays and so delimit the effectiveness of underwater sound-ranging equipment. Familiarity with these conditions will therefore aid a submarine in avoiding detection by diving to a certain depth, and it will

conversely inform surface vessels concerning ranges and depths at which enemy submarines are likely to be encountered. A knowledge of vertical density gradients due to temperature and salinity distribution may also allow a submarine to determine how much ballast must be pumped out or flooded in during a dive, and whether or not balancing is possible at mid-depths. The annual variation of surface water temperature when combined with synoptic meteorological data is useful in fog and other weather forecasting. In coastal areas, extremes of water temperature affecting the performance of personnel and equipment, and the presence or absence of ice, must be taken into account in planning amphibious operations. Likewise low salinities in coastal regions near river mouths may be important in water circulatory systems and in electrical systems when the conductivity of sea water is utilized.

(2) *Stability of hydrographic conditions in the Black Sea.*

Hydrographic conditions are sufficiently stable and fluctuate seasonally with such regularity that approximate average situations can be predicted whenever adequate data are available.

(3) *Local hydrographic factors.* Certain factors in the Black Sea are different from those in the open ocean. In a partially enclosed basin such as this, seasonal temperature changes near the surface are relatively large, whereas at depths greater than about 300 feet the temperature is nearly uniform throughout the area and from season to season; this leads to marked temperature gradients during certain seasons. The surface of the Black Sea is nowhere much more than half as salty as the open ocean. There is a definite increase in salinity with depth, however, and this factor is important in determining accurate sound ranges and buoyancy conditions.

F. Surface and subsurface temperatures.

(1) *Seasonal variation of surface temperature.*

(a) *Horizontal distribution and temperature range.* Figure III - 7 shows the annual variation of the surface temperatures in the open sea off the coast of Bulgaria. In addition to mean monthly temperatures, the maximum and minimum temperatures observed during each month are shown. The average temperature varies from 42° F. in February to 74° F. in August, and annual range of 32° F. On any given day, the sea surface temperature may be from 6° to 10° F. higher or lower than the mean monthly values.

Surface temperatures at Sozopol and in Varna Bay are also shown on Figure III - 7. In winter the mean surface temperature at these coastal points is nearly 5° F. lower than in the offshore waters, but in summer there is little variation between the three localities. In Varna Bay the temperature on any one day may be higher or lower than the mean by 10° F. in winter and over 20° F. in summer. At Sozopol, which is much less protected, the departures from the mean values are like those in the open sea; this is apparent when observations for the same years both at Sozopol and in Varna Bay are compared.

(b) *Ice.* Although northern Black Sea ports are frequently frozen over during the winter months, shipping is not troubled by ice in the southwestern Black Sea, along the coast of Bulgaria.

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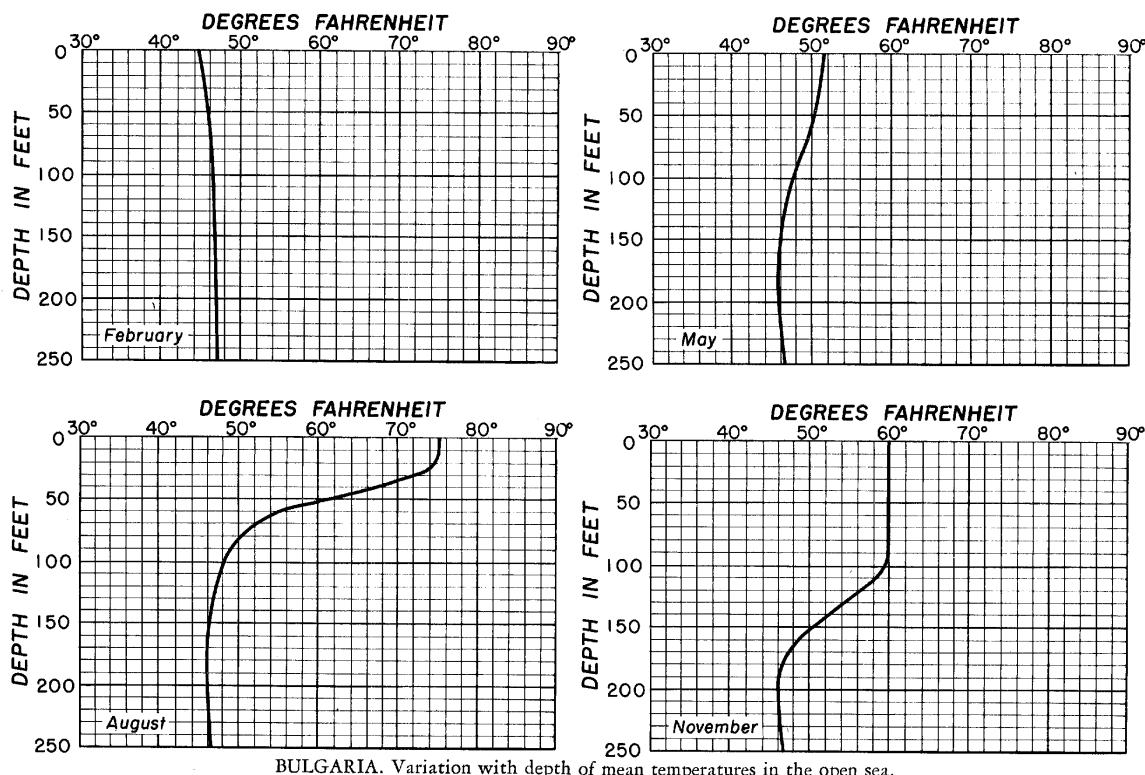
(c) *Relationship between sea and air temperatures.* The correlation between mean temperatures of the sea surface and those of the air is shown in Figure III - 7. From March through July, which is the season when fogs are most prevalent in this region, the air averages from 1° to 2° F. warmer than the water. During the remainder of the year the surface of the sea is on the average 2° to 8° F. warmer than the air. At any particular time throughout the year, however, the air may be either colder or warmer than the water, depending on the direction of the wind.

(d) *Factors controlling surface temperature.* Along the western shores of the Black Sea the variations in sea surface temperature are associated with wind force and direction.

chiefly radiational in character (Chapter IV). On the open Black Sea, however, along the Bulgarian coast, fogs occur most commonly in spring when warm, moist westerly or northwesterly winds are cooled at the base by contact with the cold sea water. Fogs are most frequent in May (about three days per month) and are rarest in August. During summer, however, occasional heavy "white fogs" come on, at times with great rapidity, in calm weather. These fogs are irregular in character, sometimes rising off the surface or clearing away altogether for a few moments.

Cold northeasterly winds in winter bring clear skies, but after prolonged light winds from this direction a low thick haze develops along the Bulgarian coast.

FIGURE III - 8



BULGARIA. Variation with depth of mean temperatures in the open sea.

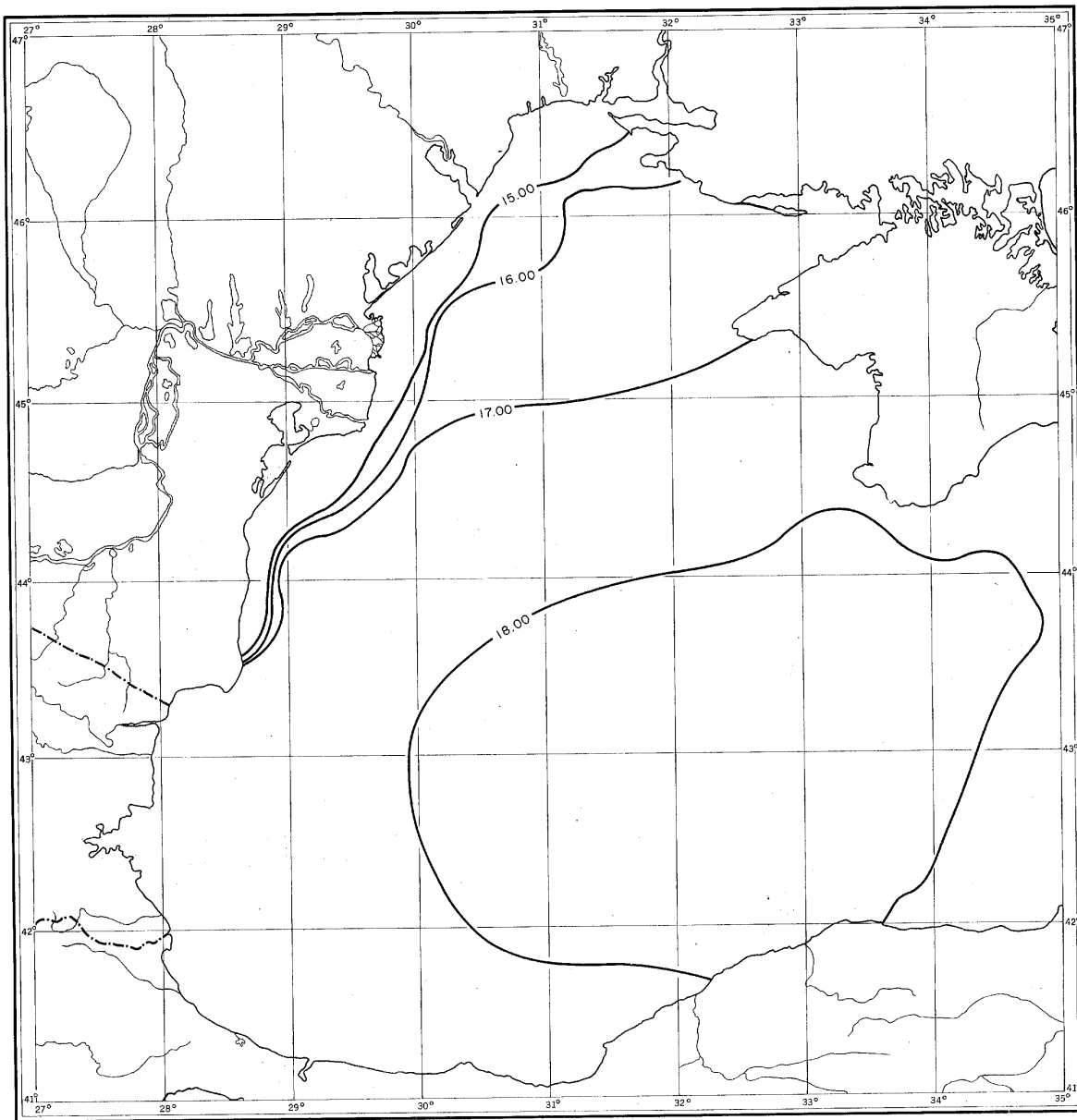
After a strong offshore wind has blown for some time, the warm surface water is blown away from shore and is replaced by cold water upwelling from the depths. This phenomenon is especially conspicuous along the Rumanian coast, but it probably exists also off Bulgaria. Near Constanța on July 15, 1932, the sea surface temperature was 73.4° F.; the following day, after a strong westerly wind, it had dropped to 53.6° F. This upwelling water, which is known to the local fishermen as the "glacial current," is more saline than the warm surface water which it replaces. It often has an odor of hydrogen sulfide and is particularly destructive to the warmer water fishes. During calms or light breezes in summer, the surface waters become rapidly warmer, especially in protected areas near shore, as at Varna (Figure III - 7).

(e) *Occurrence of fog.* Fog at Varna is most common during the fall and winter (three to four days each month) and is

(2) *Variation of temperature with depth.* The variations with depth of the mean temperatures in the open sea during each season are shown in Figure III - 8. In depths greater than 300 feet, the temperature is practically constant throughout the year, ranging from 47° F. at 300 feet to 47.5° F. at 600 feet. In February and March the water column is roughly isothermal to a depth of 600 feet, although it is coldest at the surface. In May the surface layer begins to warm up and a slight negative gradient (temperature decreasing with increasing depth) is produced to a depth of 150 feet. In June this gradient increases in extent and sharpness above 100 feet and reaches a maximum in July and August when there may also appear a subsurface layer of nearly isothermal water to a depth of 20 feet. With decrease of the gradient in the fall, the isothermal layer increases in depth, reaching a maximum of 100 feet or more in November. Temperature gradients

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FIGURE III - 9



SURFACE SALINITY

(Parts per Thousand)

are sharper and closer to the surface in shallow water. In winter there may be a pronounced positive gradient near the coast during periods of rapid surface cooling.

G. Surface and subsurface salinity.

(1) Seasonal variation of surface salinity.

(a) *Horizontal distribution.* The general distribution of surface salinities in the western Black Sea is shown in Figure III - 9. Salinities at the surface vary from a minimum of 2.68 parts per thousand near the northwestern shore to a maximum of 19.61 parts per thousand south of the Crimea. Although there is considerable variation from one station to another, no definite seasonal distribution is apparent in the offshore waters.

(b) *Salinity range.* Along the Bulgarian coast, the salinity of the surface water is similar to that of the open sea, except near the rivers where the values may be slightly to very appreciably lower, depending upon the runoff from the river and the wind direction and force. In Varna Bay, during periods of river floods, the surface salinity south of the breakwater within a few hundred yards of the canal leading from Lake Varnensko may be as low as ten parts per thousand. This effect is not noticed along the north shore of the bay, which is protected by the breakwater from the influence of the inflowing fresh water. Elsewhere in the bay, the surface salinity is never less than fourteen parts per thousand and it usually varies between sixteen and eighteen parts per thousand. It is probable that similar low salinities are found during floods at the head of Burgaz Bay.

Strong west and northwest winds in winter may carry much of the coastal surface water out into the open sea with a resultant upwelling of deeper, more saline water; the salinity may therefore become greater than 18.00 parts per thousand for variable lengths of time in winter depending upon the strength of these westerly winds.

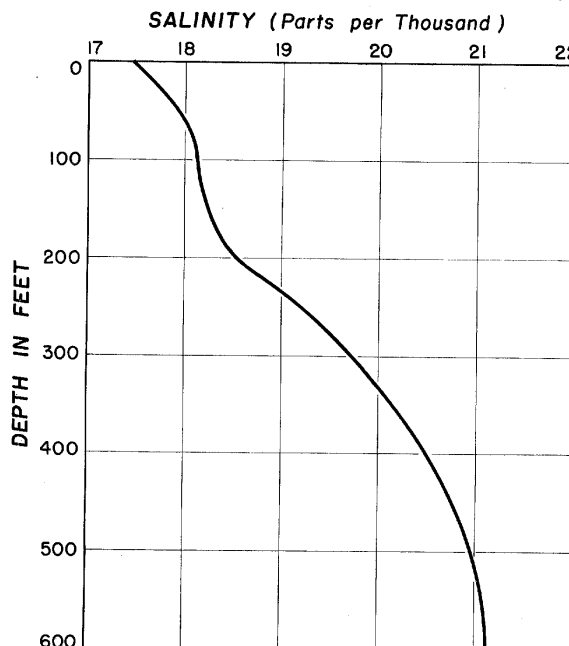
The variation in surface salinity in Varna Bay for ten-day periods throughout the year is shown in Figure III - 10. Dur-

ing a single day, the surface salinity may vary by as much as three parts per thousand.

(c) *Electrical conductivity.* The specific electrical conductivity of the surface water at Varna, computed from the minimum and maximum temperature and salinity values, varies from 0.017 to 0.032 reciprocal ohms per cubic centimeter in summer and from 0.013 to 0.022 reciprocal ohms per cubic centimeter in winter.

(2) *Variations of salinity with depth.* The subsurface waters increase in salinity with depth as shown in Figure III - 11.

FIGURE III - 11

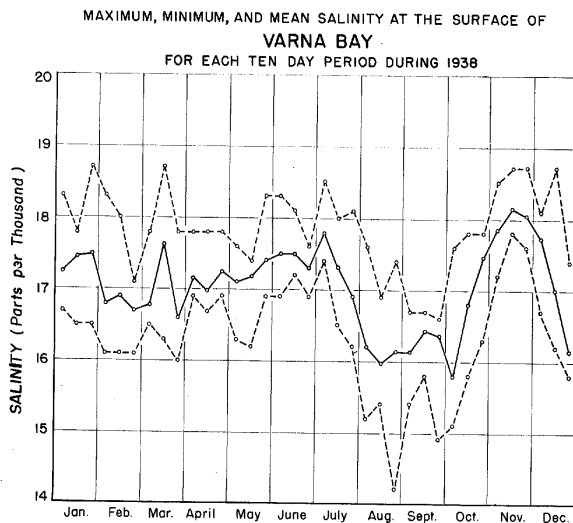


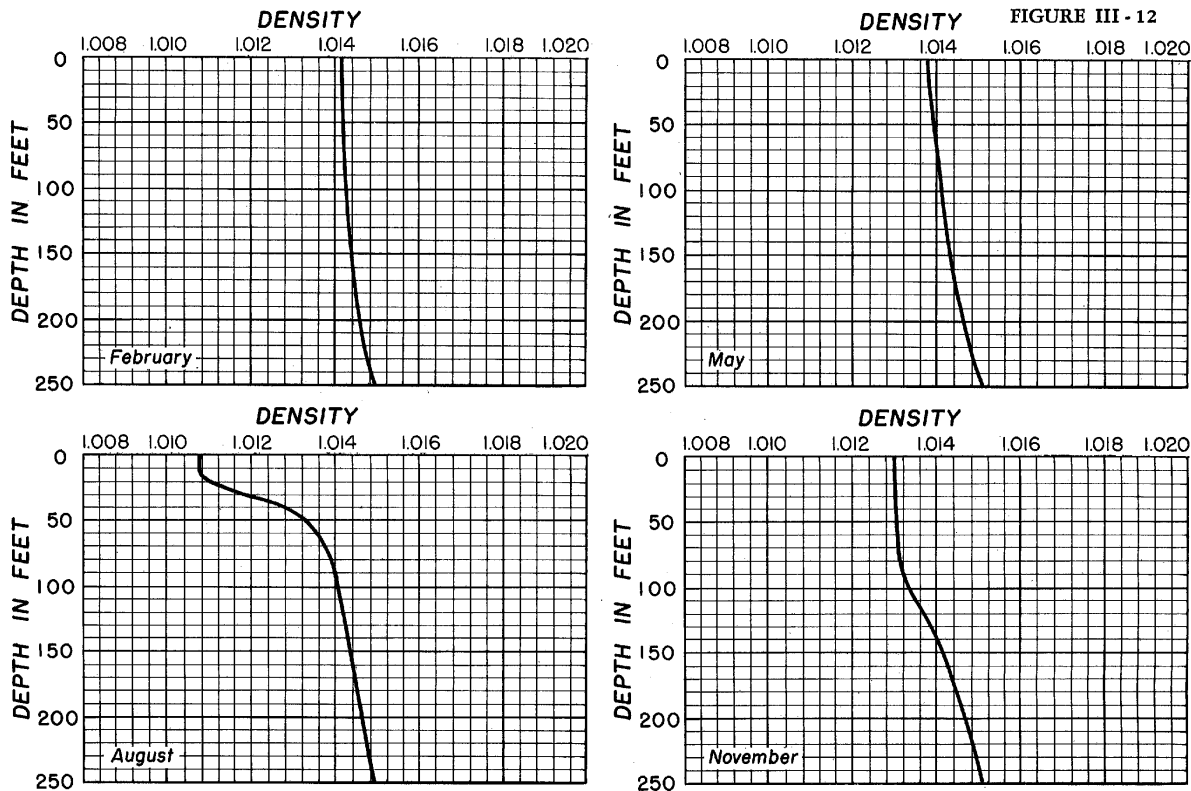
VARIATION WITH DEPTH OF THE MEAN SALINITY OF THE WESTERN BLACK SEA

At 150 feet, the mean values range from 18.10 parts per thousand along the edge of the shelf which makes up the floor of the northwestern part of the sea to 18.50 parts per thousand south of the Crimea. At 300 feet, there is a similar pattern with mean values of 19.00 parts per thousand to 20.50 parts per thousand.

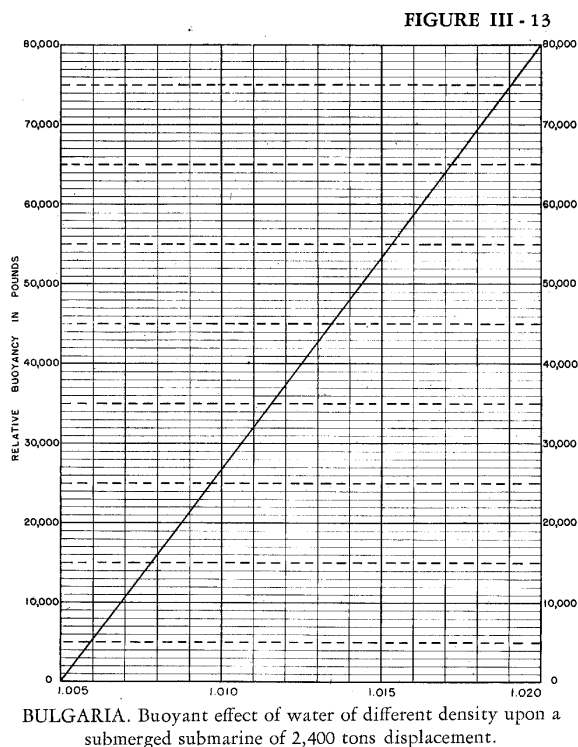
H. Density.

(1) *Variation of density with depth.* Everywhere in the ocean the density of the water must be either constant or increase with depth, but the rate of increase depends on the vertical distribution of temperature and salinity. Both temperature and salinity gradients produce a marked effect on the density distribution in the Black Sea, and these gradients do not always coincide in depth. A density gradient of about 0.001 per hundred feet always exists in this area between 200 and 300 feet because of the salinity. In summer another and much sharper density gradient develops at depths less than 100 feet because of the combined effect of temperature and salinity (Figure III - 12).



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BULGARIA. Variation of density with depth by seasons.



BULGARIA. Buoyant effect of water of different density upon a submerged submarine of 2,400 tons displacement.

(2) *Use of density gradients by submarines.* The density gradient is sufficiently well marked in midsummer to allow a submarine to balance in neutral trim with its motors stopped at periscope depth in July and August. In September, October, and November this gradient is somewhat deeper and less sharp; it is probable that a submarine can balance during these months at keel depths of from 120 to 170 feet. From December through May balancing will be doubtful, and not until June will it again become probable.

With the aid of Figure III-13, a submarine of 2,400 tons submerged displacement wishing to dive from one depth to another may calculate the ballast adjustment necessary to compensate for the vertical density gradients by using the density values at the depth for a particular season given in Figure III-12. Submarines of other tonnages should multiply the value obtained in this manner by the ratio of their own submerged displacement to 2,400 tons.

I. Bottom sediments.

(1) *Characteristics of sediment types.* A knowledge of the distribution of the bottom sediments over the continental shelf is important in predicting underwater sound conditions, in mine warfare, and in planning landing operations.

Data on bottom sediments for the coast of Bulgaria are unfortunately particularly scanty, but a fair estimate may be made from geologic and hydrographic reports and charts.

The characteristics of the types of sediments found along the Bulgarian coast are given in Table III-3.

TABLE III - 3
BULGARIA, CHARACTERISTICS OF TYPES OF
SEDIMENTS ALONG COAST

TYPE OF BOTTOM	EFFECTS ON SOUND RANGING CONDITIONS WHEN TEMPERATURE GRADIENTS ARE NEGATIVE	SUITABILITY FOR MINE FIELDS
<i>Sand.</i> Firm relatively smooth bottom, shells and washed gravel included.	Long extension of range commonly obtained.	Good.
<i>Sand and mud.</i> Relatively firm, smooth bottom, including firm clay.	Moderate extension of range.	Good.
<i>Mud.</i> Soft, smooth bottom.	Sound commonly absorbed, little extension possible.	Poor. Ground mines may sink in mud.
<i>Rocky.</i> Rough broken bottom, including bedrock outcrops and areas covered by boulders.	Strong reverberations tend to mask echoes. Extension of range unlikely with either echo ranging on listening.	Poor. Strong currents to be expected.

(2) *Horizontal distribution.* Along the open coast, the bottom out to about 30 or 40 fathoms over the shelf is *sand and mud* with some areas of *sand*. The greatest depth where *sand and mud* occurs in the Black Sea is at a depth of 58 fathoms opposite to the opening of the Bosphorus, the sand being transported there by the inflowing undercurrent. More or less clean sands such as are found along the Atlantic coast of the United States are confined to depths less than five fathoms. Extensive banks of mussels, oysters, and scallops are found in the *sand* zones and there is a considerable admixture of mussel shells in the *sand and mud* sediments. Off the headlands, hard, rough *rocky* bottom is probably to be found even when not noted on the chart.

On the navigational charts (B.A. charts 2230, 2399 and 2285), *mud* occurs frequently within the 30 to 40 fathom curve, but in all probability the deposit has a considerable admixture of sand and shell and behaves acoustically and in other ways like a firm *sand and mud* bottom as defined above. The firm sediments combined with the level sea bottom should give good sound ranging conditions in shallow water.

From the 40-fathom zone out to 100 fathoms, the bottom material becomes softer and hence the classification *mud* (as defined above) is justified. This mud is described as being dark blue-black in color when freshly collected and contains a considerable amount of shelly material.

The harbors and bays, as well as the shelf, show a firm *sand and mud* bottom with occasional *rocky* patches and shoals (see accompanying charts, for Burgaz Bay, Varna Bay, and the area westward from Nesebr).

In Varna Bay, where the information appears to be quite detailed and reliable, mixtures of sand and gravel (classified as *sand*) occur around the periphery of the bay, while in the open bay, there is a fine ash-gray clay (Fig. III-14).

In the Gulf of Burgaz, an equally reliable, but less detailed report of the distribution of the ash-gray clay exists. In both cases, this material is of a firm clayey consistency and has therefore been classified as *sand and mud* on the accompanying charts (Figures III - 15 and III - 16).

(3) *Mines.* The distribution of bottom sediments is such that the entire Bulgarian coastline between ten and 100 fathoms is suitable for defensive moored mines. The most probable location of plants would be the outer approaches to harbors or at minimum distances of two to three miles off possible landing beaches along the coast.

J. Acoustic conditions.

(1) *Seasonal variation.* Good conditions for echo ranging by surface ships on submarines (assured range greater than 2,500 yards) prevail during the winter months, as shown in Figure III - 17. However, false echoes and high reverberation may be obtained at a range of about 3,000 yards due to a concentration of sound reflected from the sea surface. Such false echoes may be distinguished from a submarine echo by the fact that they occur all around the horizon and exhibit no doppler effect. In spring, conditions for sound ranging become increasingly less favorable, and in late spring and early summer poor to bad echo ranges (assured range from 1,500 to less than 750 yards) will prevail in deep water (see Figure III - 17), unless winds of force four or more mix the subsurface layer. In late summer (see Figure III - 17), ranges will be poor to fair (assured range from 750 to 2,500 yards) depending upon the wind. Light winds and poor echo ranges occur 50 to 60 per cent of the time; wind forces of three or four will produce fair conditions during 20 per cent of the time; and winds of force five or more will cause fair to poor conditions 15 to 20 per cent of the time. In summer, during periods of calms or light breeze, acoustic conditions will be worse during the hours from 1200 to 2200 than during the remainder of the day because of the "afternoon effect." Listening ranges in deep water will be less than 2,000 yards in late spring and early summer and will not exceed 4,000 yards in late summer. In the fall, listening and echo ranging (Figure III - 17), conditions will improve rather rapidly in the upper 50 to 100 feet. During summer, echo ranges will probably be extended in water from 50 to 250 feet deep because of reflection from the firm *sand and mud* bottom. Reverberations from rocky bottom will not be encountered in depths greater than 50 feet, and will be unusual even near the coast.

The marked salinity gradient in the Black Sea must be taken in precise calculations of sound ray paths, but it has little practical effect on either echo ranging or listening.

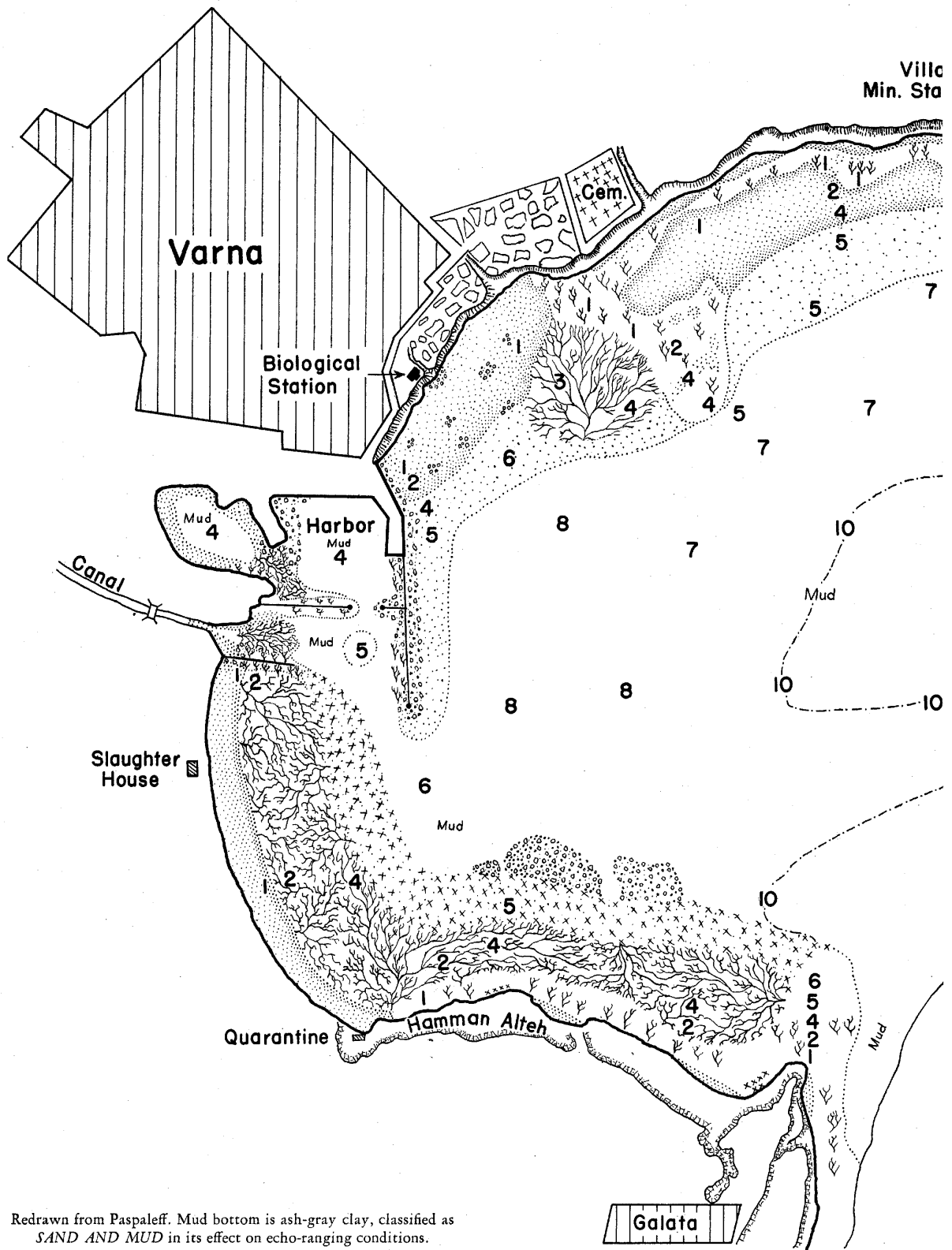
(2) *Variation with depth.* Because of the pronounced "layer effect" in summer, a submarine, by submerging below 50 feet will gain protection from echo ranging detection during that season. This layering is even more pronounced in shallow water than it is away from the coast; a submarine can therefore probably best avoid detection by resting on the bottom. By September the thermocline has started downward, and by November a submarine would need to submerge to 150 feet to avoid echo-ranging surface vessels.

(3) *Background noise.* None of the noise-making animals, which interfere with the use of listening devices in certain areas, occur in the Black Sea. However, fish feeding on the abundant molluscan fauna in shallow water might produce a high background noise level. In offshore waters the abundant schools of mackerel and shad, as well as the three species of Black Sea porpoises, may make noises which would occasionally be misleading to sound operators.

K. Transparency and color of water.

(1) *Transparency.* Although considerable Russian data exist on transparency of the Black Sea, these data are apparently not available in the United States. The scanty evidence on hand indicate, however, that the waters of the western Black Sea are never very clear and that the transparency is particularly low in spring during periods of floods in the Danube and in the other major rivers entering the sea along

GULF OF VA BOTTOM SEDIMENT Depth in Fathom

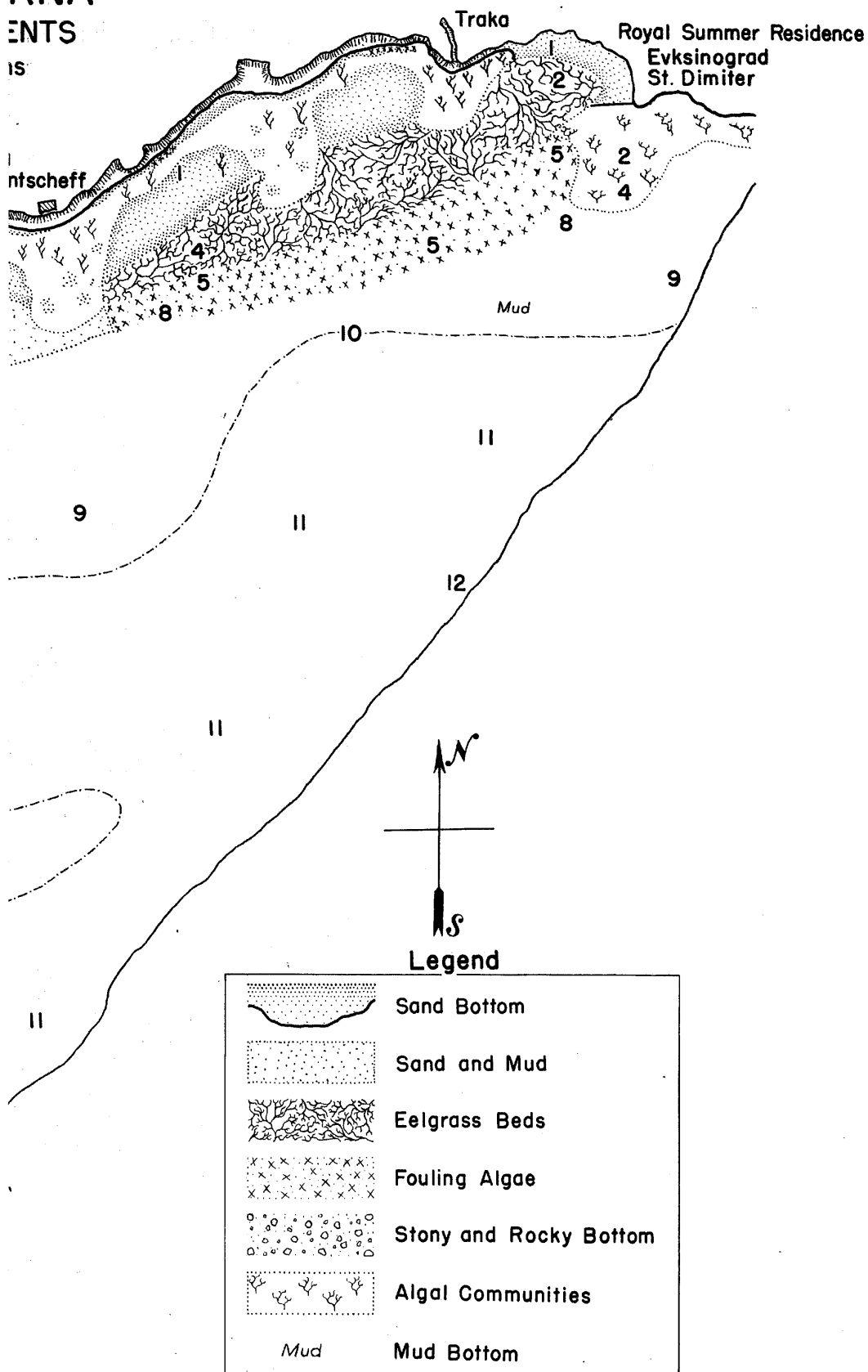


Redrawn from Paspaleff. Mud bottom is ash-gray clay, classified as SAND AND MUD in its effect on echo-ranging conditions.

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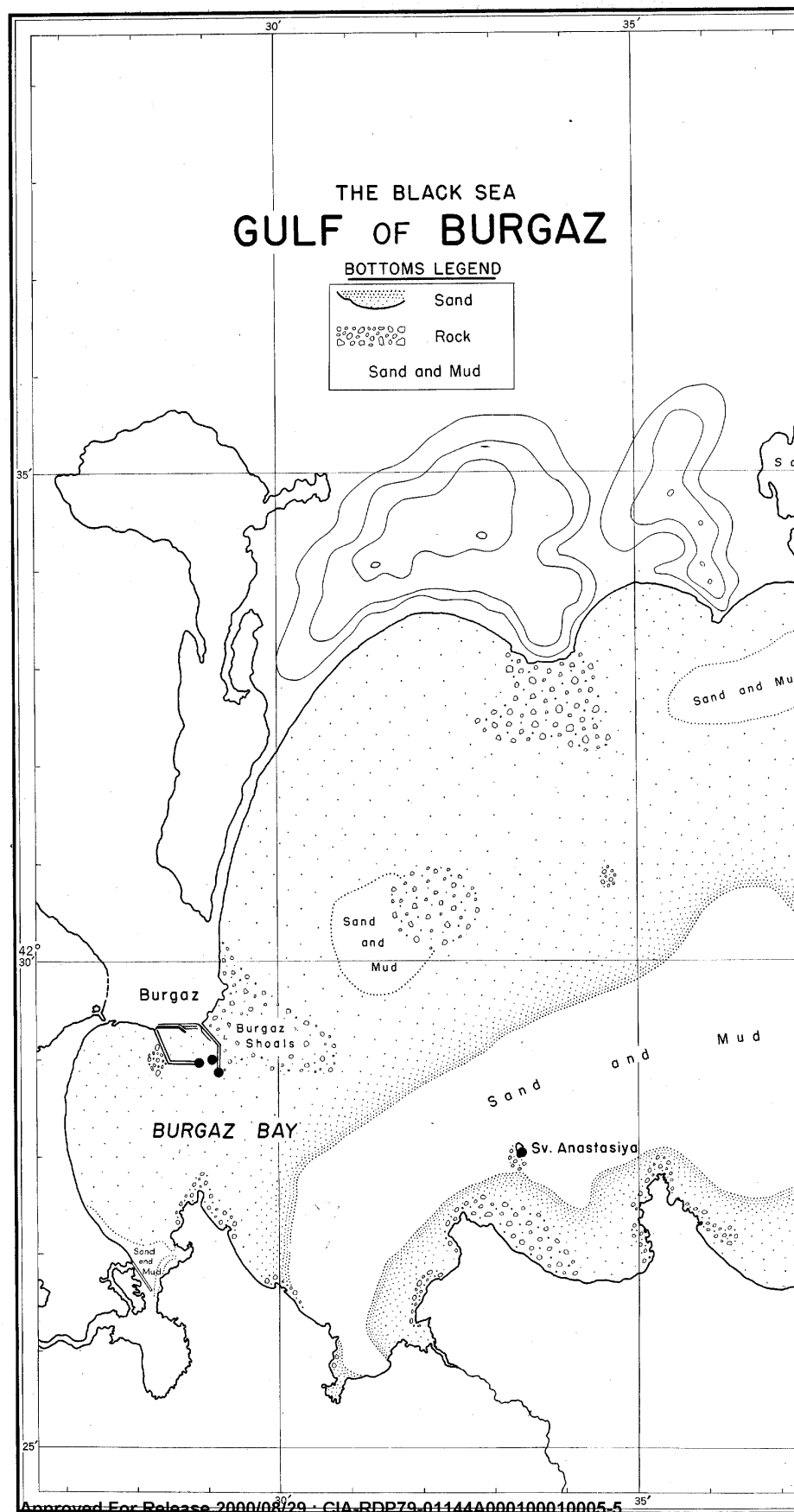
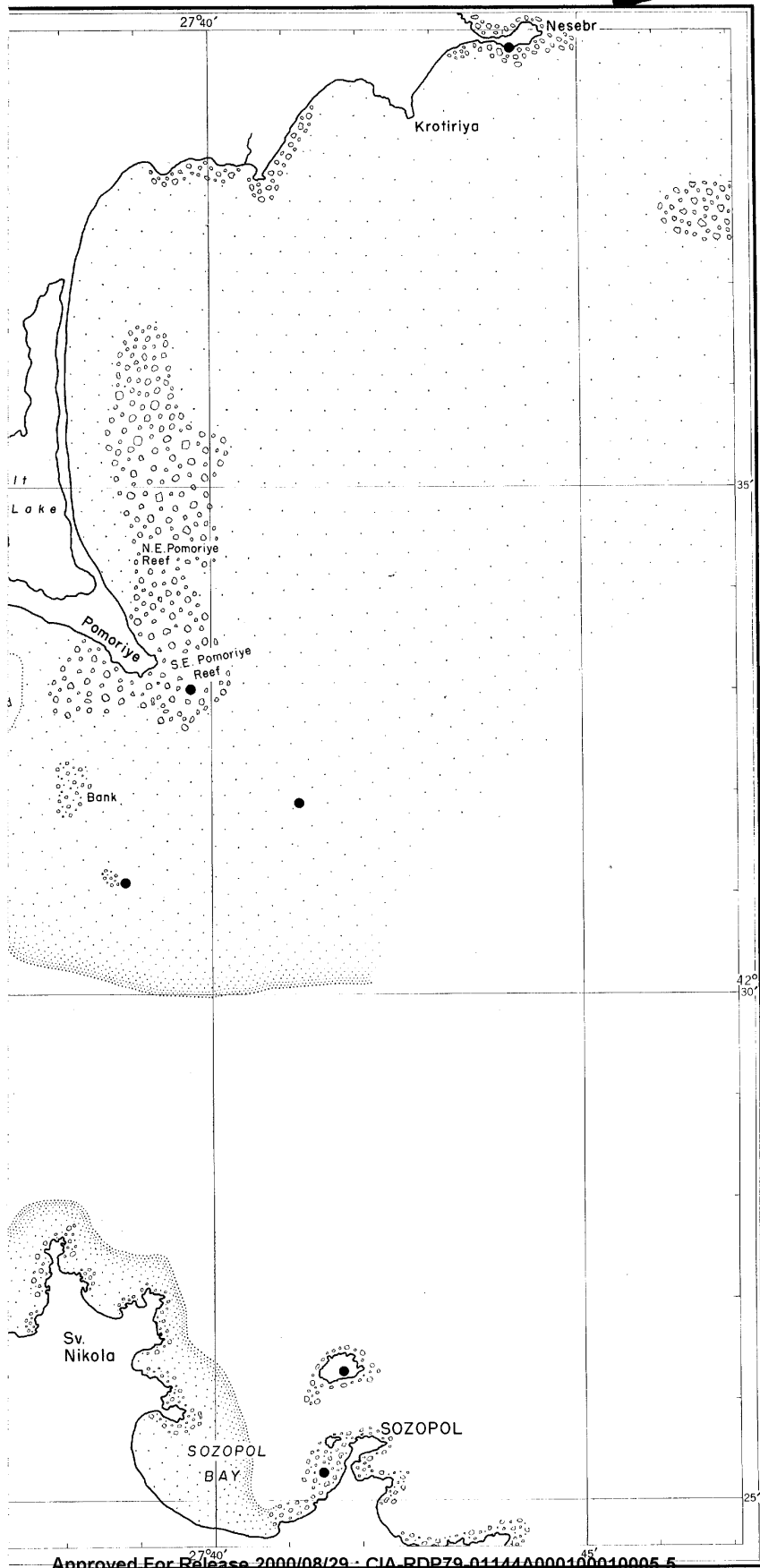


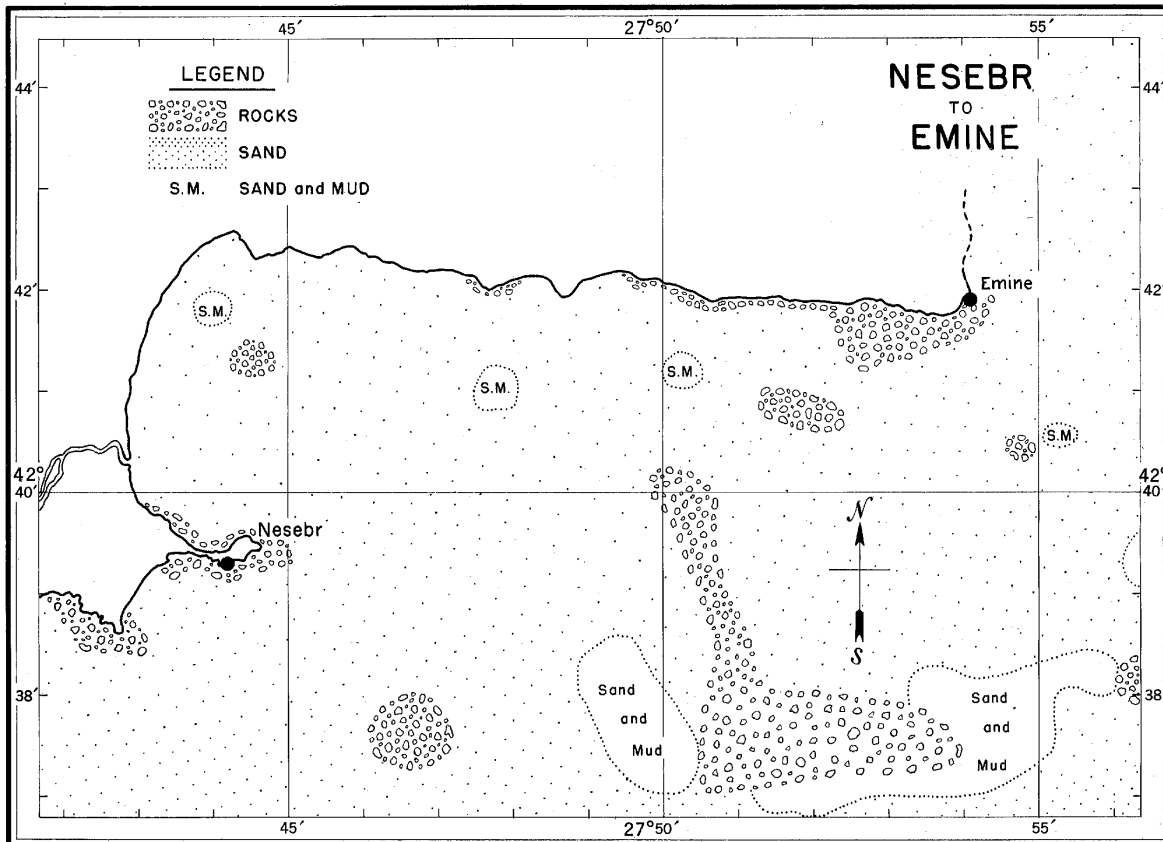
FIGURE III-15

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FIGURE III - 16



the Rumanian and Russian coasts. At that season, a white object (Secchi disc) can be seen only a few meters below the surface.

(2) *Color of water.* No data available.

L. Biological factors.

(1) *Sea-weed and eel-grass.* The species of sea-weed which occur in this area are relatively small and grow attached to rocks either at the beach or in deeper water offshore. It is therefore improbable that they would interfere seriously with amphibious operations. On rocky beaches these small forms would probably make submerged rocks slippery to climb about on.

Eel-grass grows along the coast in relatively protected parts of the bays in depths of two to four fathoms (Figure III - 14). However, even where it grows luxuriously as on the southern shore of Varna Bay it does not interfere with setting fish weirs. Hence, eel-grass would not appear to be a hindrance to amphibious operations.

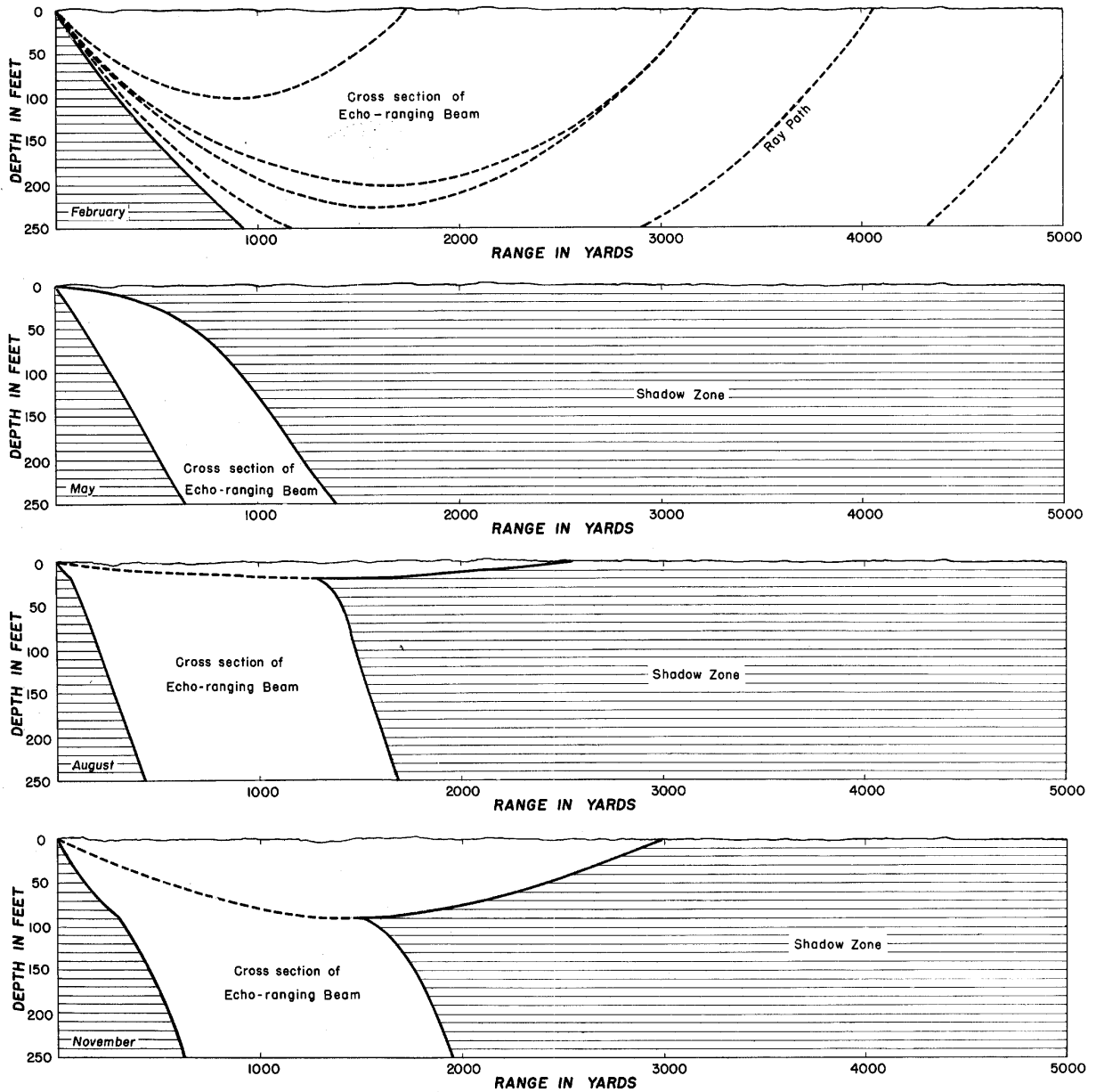
(2) *Luminescence (phosphorescence).* Night detection or concealment of PT boats and other fast-moving craft are seriously affected by the luminescence ("phosphorescence") of their wakes and bow waves due to small light-producing organisms in the sea water. Thus, in Pacific combat areas

PT boats have found difficulty in avoiding detection on moonless nights because of the relative increase in brightness of the luminescent glow from their wakes. Intense luminescence may also confuse navigators and interfere with the dark adaptation of lookouts.

The presence in unusually large numbers off the Bulgarian coast of the highly luminescent organism, *Noctiluca*, indicates that luminescence is common in that area. This phenomenon is utilized by the local seine fishermen who customarily fish only on the dark of the moon, when schools of fish are most readily detected by the comparatively bright flashes of luminescence caused by the fish swimming through the water.

(3) *Fishing grounds.* The chief fishing areas for marine fish along the coast of Bulgaria are situated in the bays and harbors and within one-half to one and one-half miles of the shore along the open coast. In addition, flounder fishing grounds are situated 13 to 16 miles offshore in depths of 40 to 55 fathoms and are reached in small open sailing boats about the size of whale boats. The largest fisheries are located at Pomoriye (Ankhelu), Burgaz Bay, Sozopol, Tsarevo (Vasiliko), and Akhtopol, but fishermen may be encountered anywhere near shore, particularly on dark moonless nights. On such nights, a fleet of small row boats will be seen following a larger boat with a man perched atop the mast to give the alarm of approaching fish as revealed by luminescent streaks in the water.

FIGURE III - 17



BULGARIA. Seasonal variation in acoustic conditions.

Considerable fishing for both fresh water and marine fish take place in brackish lakes connecting with the sea, such as Varna and Mandra Lakes.

(4) *Fish traps.* Fixed fish weirs called "dalyans" are found on the Bulgarian coast which might hinder amphibious operations. These weirs are located close to the headlands of harbors, in places where the fish pass close to the shore, but are not set directly on the tip of a promontory in order to avoid the strongest currents. The weirs are essentially like the pound nets found along the eastern coast of the United

States with a net stretching from the shore out some 150-200 yards to a large rectangular trap. However, they appear to be more permanent fixtures. Only the well-anchored piles to which the nets are attached may be expected to be visible above the water.

In Varna Bay, nets are located northward of Cape Galata, extending 100-150 yards offshore and between Hammen Alteh and the foul ground northward (Figures III - 14 and XIII - 1) extending 150-200 yards from shore.

Other types of small nets are used close to shore and reed traps are used in the brackish lakes.

32. Coastal Hydrography

A. Offshore zone.

Off the coast of Bulgaria, the bottom of the Black Sea rises steeply to the 100-fathom curve, beyond which the slope toward the land is much more gradual. A depth of 700 fathoms is found at about 35 miles from the shore, while the 100-fathom curve lies at an average distance of about 28 miles, the 50-fathom curve at 23 miles and the 30-fathom curve at 18 miles. Along the southern part of the coast, below the Gulf of Burgaz, the 20-fathom curve is about one mile from the shore, but north of the gulf this distance steadily increases from one and one-half miles off Cape Emine to 15 miles off the shore of Batova Bay (Figure III - 18). Off the Gulf of Burgaz the 20-fathom curve is not far from the line joining the two entrance points (Baghlar Point and Cape Emine) and soundings within this line decrease very gradually, a depth of four fathoms being found almost everywhere at 500 yards from the shore. The average depth in the bay is about 12 fathoms.

North of Cape Emine, the soundings near the land are very even, the ten-fathom curve lying at a distance of about 750 yards from the shore all along the coast as far as Cape Galata, the southern entrance point of Varna Bay.

Off Varna Bay, the ten-fathom curve follows quite closely the line joining the two entrance points (Cape Galata and Cape Sveti Georgii), and inside the bay the soundings are evenly distributed, the three-fathom curve being about 250 yards from the shore. The average depth of the bay is about seven fathoms.

Along the short stretch of coast north of Cape Sveti Georgii, the five-fathom curve is about 750 yards from the shore and the latter is fringed by a bank which extends from Monastery (Chingani) Reef to Balcic.

Except in the case of Varna Harbor, for which a special chart is included in this chapter (Figure III - 14), very little information is available on the nature of the sea bottom along the Bulgarian coast, especially offshore. Within a distance of two miles off the coast the bottom appears to be composed of mud, sand and shells, either singly or in composition. Some isolated spots of rock are indicated off Galachiya (Galajio) Point, and a little less than one mile off Tsarevo (Vasiliko), as well as immediately southwest of Pomoriye (Ankhelu) (Figure III - 15), one and one-half miles north of Nesebr (Messemvria) (Figure III - 16), and along the northern shore of Varna Bay.

B. Coastal currents.

The currents in the Black Sea (Figure III - 2) consist, essentially, of a main circulation setting counter-clockwise along its shores, with several branches connecting its various parts. These currents are, in general, weak and inconstant. They are due to two causes; the outflow of the rivers, the bulk of which enters the northwestern part of the sea, and the influence of the wind. Variations in the amount of the discharge from the rivers, and variations of the wind distribution, due to the passage of depressions and other causes, may affect the normal currents to a very large extent, and, in some areas, may even reverse their directions.

The strength and consistency of this current circulation is greatest, as a whole, after the melting of the snows in late spring and early summer, this being the season when the discharge from the rivers is greatest. In this season an increase in the rate of the current may occur, particularly off the mouths of the large rivers; this may also occur after periods of heavy rain at any time of the year. In late summer and autumn, when the volume of water discharged by the rivers is relatively small, the circulation, as a whole, is weaker and more subject to changes due to the influence of the wind.

The discharge from the Dnyepyr (Dnepr, Dnieper) estuary (Kherson Bay) flows westward along the coast of Odessa (Odessa), and thence southward along the western shore to the delta of the Danube, receiving on its way the outflow of the Dnyestr River. The main rate of this current is from one-half to three-quarter knot. The current then receives a great accession of water from the Danube and sets south-southwestward, but it gradually becomes wider and decreases in strength, so that, off Constanța (Constanta, Constantza), its rate is less than one-half knot. Here its color is yellowish-green, from the outflow of the Danube. In the latitude of Varna, the current is joined by a weak current which sets west-southwestward from the southern coast of the Crimea, and the combined current then sets southward and south-southeastward to the northern entrance of the Bosphorus.

The current does not enter the extensive bight between Cape Caliacra (Kaliakra) and the Bosphorus. On the parallel of Servez Point (Serveh Burnu), a weak branch curves away from the main current toward the shore, along which it passes northward as a counter-current. This counter-current has been observed to flow along the shores of Balcic (Baljik) Bay; southward of Cape Caliacra, it trends westward and rejoins the main current. The rate of this counter-current is from about one-quarter to one-half knot.

A British naval officer, on a voyage from Burgaz to Istanbul (Constantinople), reported that "with a moderate gale from the north-northeast, an unmistakable set on to the coast and to the southward was experienced, amounting at first to only one-half knot, but getting stronger as the wind increased, and was such as might have caused the loss of vessels had the coast lights not been seen." On the return trip from Istanbul to Burgaz, the same officer remarked that "with calms and light southerly winds, no current was experienced, which appears to point to the fact that the currents are greatly influenced by the prevailing wind." Another navigator, while corroborating the above remarks, states that, if southeasterly or southerly winds have been blowing for three or four days, a set of about one-half knot will be observed in a northerly direction.

C. Underwater defenses.

Burgaz Bay and Varna Bay, with moderate depths, no tide, and little current, are well suited to mining and counter-mining operations, and the entrance to the inner harbor in each bay, with a width of about one mile, could easily be protected by the use of nets. These are the most probable, if not the only feasible, locations for such underwater defenses.

Black Sea
Cape Kuri to Balcic

Lighthouse ●
Letters refer to text sub-
topics containing descrip-
tion of coast A
Soundings in fathoms
Heights in feet

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33. Coasts

A. Cape Kuri to Galachiya Point.*

(1) *Coast in detail.* The coast between Cape Kuri (Kuri Burnu) and Cape Stefano is lined with dark cliffs and overgrown with brushwood. Cape Stefano, 4 miles north of Cape Kuri, is low and rocky, with only a slight projection from the general coastline. It can be made out only when close aboard. The slopes of the hills at the back of the cove are quite bare and thus easily distinguishable from the cliffs at Cape Kuri which are covered with trees. At the foot of these hills are found the remains of former entrenchments. North of Cape Stefano there is a small cove with a wide, sandy beach bounded on the north and south by rocky points. The village of Stefano (Ayastafanos) lies somewhat inland on high ground near the south end of this cove. On the north end of the cove, among large trees, there are a few houses, with a stream below them.

Galachiya Point, about 8 miles north of Cape Stefano, is bare and not prominent, and can be made out only when close aboard. Somewhat to the north, there is a stream-bed with a sandy beach and a small grove of trees. From a position to the east or northeast of the point, can be seen the village of Galachiya, situated on high ground a short distance inland.

*Sections of the coast as described under this and the following sub-topics are indicated on Figure III - 18.

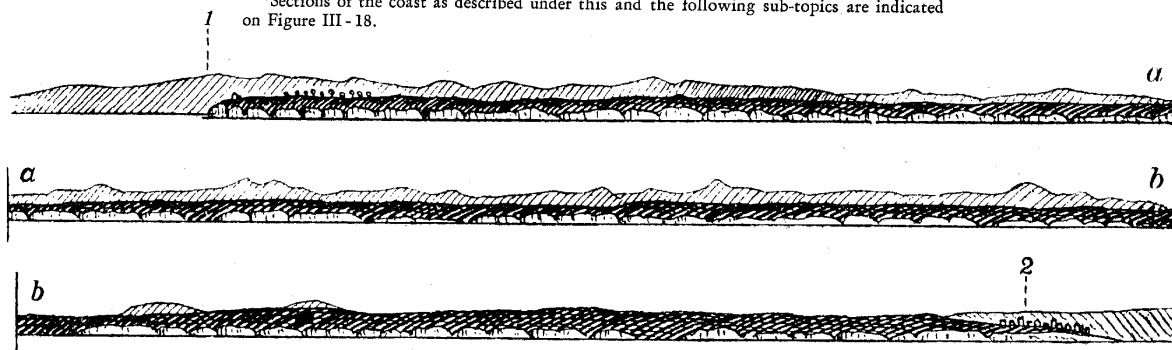


Illustration III - 1. From Cape Kuri to Stefano.
1. Cape Kuri, 219°, 6½ mi.; 2. Stefano, 258°, 7 mi.

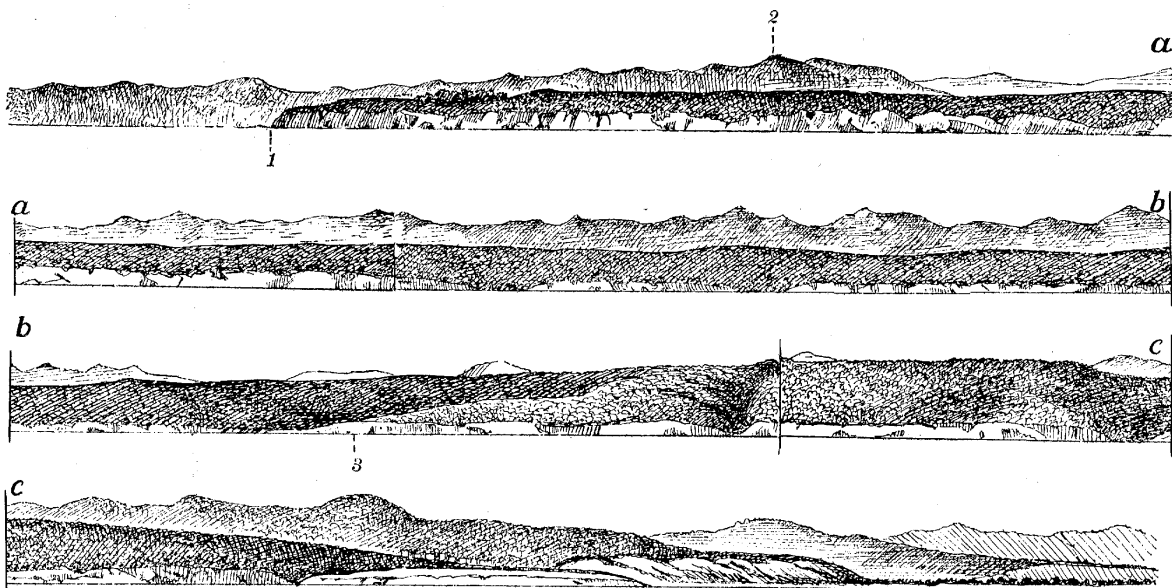


Illustration III - 2. From Cape Kuri to Stefano.
1. Cape Kuri, 207°, 6¼ mi.; 2. Mt. Igne Ada; 3. Cape Stefano, 242°, 3¼ mi.; 4. Stefano.

B. Galachiya Point to Tsarevo.

(1) *Coastal description.* About 15 miles north of Cape Kuri is the little town of Akhtopol which stands on a steep, rocky point of reddish color, about 52 feet above the water, and recognizable from a distance by the windmills on the end of the point. Another point, about 25 feet high, lies to the south of the town, and the two points enclose a cove which forms the harbor, with an entrance about 100 yards wide. Seen from the northwest or southeast, at a distance of 10 miles, Akhtopol appears to be an island.

Mount Paphia, 4 miles inland from Akhtopol, is 1,680 feet high. It is easily distinguished in clear weather from a distance of 40 miles by its conical shape and its detached position, near Malaya (Little) Paphia.

The small harbor of Tsarevo (Vasiliko) is protected by a breakwater and lies about 5 miles north-northwest of Akhtopol (Agathopoli) on a steep point at the extremity of which there is a group of windmills. A bay which lies to the north of the town forms the harbor, with a beach of gray sand at its head. This bay is bounded on the north by the low, white Limnos Burnu.

Along the coast between Akhtopol and Tsarevo there are several low, rocky points, from which reefs extend about $\frac{1}{2}$ mile to seaward. The slopes of both Mount Paphia and Malaya (Little) Paphia extend down to the shore.

(2) Anchorage area.

(a) *Akhtopol (Agathopoli) Cove.* There is anchorage for small craft, with local knowledge, in this cove. It is obtainable in about 4 fathoms, sand, with shelter from all but easterly winds; under these winds approach should be nearer to the town. A breakwater, extending in a northerly direction, affords some shelter for vessels of not more than 16 feet draught, and there is a quay with about 300 feet frontage. The greater part of this cove has depths of only about 2 fathoms. The entrance is about 100 yards wide and has depths of $4\frac{1}{4}$ fathoms; it lies between a reef of rocks, most of which are visible, which borders the northern side, and the southern entrance point, which is steep-to.

(b) *Tsarevo Cove.* Large vessels can obtain anchorage in depths of from 11 to 15 fathoms, sand, off the entrance to Tsarevo Cove. Within the cove there is a small harbor, protected by a breakwater, with two quays, with lengths of about 300 and 250 feet, respectively, alongside which small craft with local knowledge can secure.

(3) Dangers to navigation.

(a) *Tsarevo Cove.* East of the southern point and about 700 yards offshore, there are some above-water rocks. A reef extends off the western entrance point.

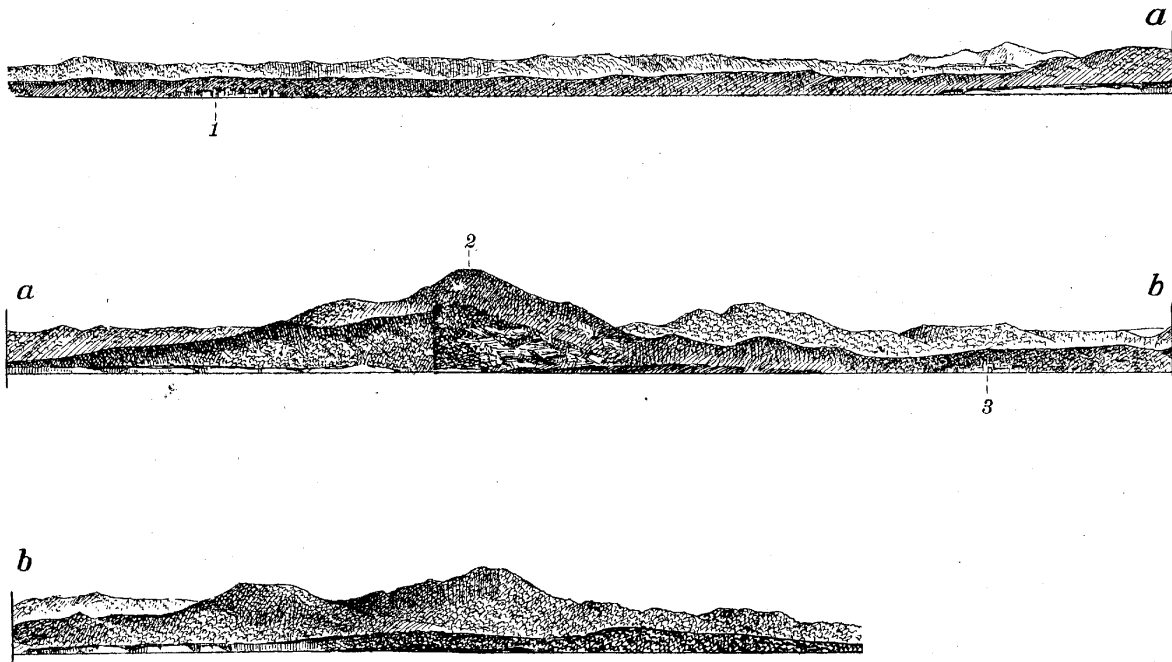


Illustration III - 3. From Akhtopol to Tsarevo.
1. Akhtopol, 185°, 7¾ mi. 2. Mt. Paphia; 3. Tsarevo, 227°, 6 mi.

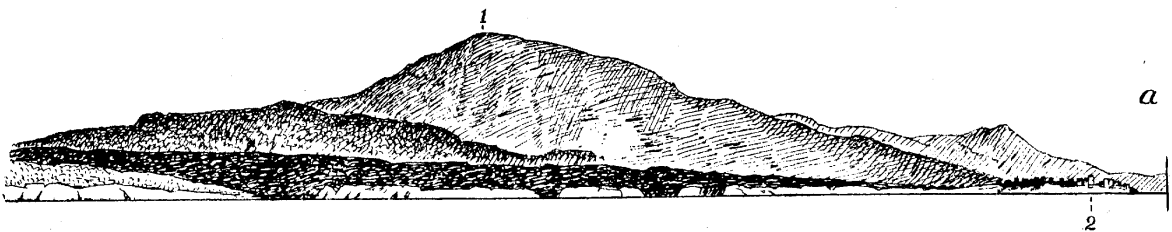


Illustration III - 4. Akhtopol and Mt. Paphia.
1. Mt. Paphia; 2. Akhtopol, 303°, 5½ mi.



C. Gulf of Burgaz and approaches; Tsarevo to Cape Zeitin.

(1) *Coastal description.* About 5 miles northwest of Tsarevo lies the white, rocky Kara Agatch Point, with the village of the same name, easily distinguishable by a clump of large trees. On the point are the ruins of walls, with towers and tombs. A reef extends from the point about 1 mile to the southeast, sheltering the small Kara Agatch Cove.

About 1½ miles to the north of Kara Agatch Cove is the small Dyavolski (Athanatos) Bay, open to the east, and formed by Nos At Liman (Athanatos Point) on the south and Zunaritsa Point on the north.

Cape Zeitin, 3 miles northeast of Zunaritsa Point, is high and steep and projects considerably to the east. Baghlar Point (Nos Kuratan), 2 miles north of Cape Zeitin, is safe to approach and is the southern entrance point of the Gulf of Burgaz, the other entrance point being Cape Emine, 23 miles to the north. From the line joining these two points, the gulf extends into the land for a distance of 17 miles to the westward, with the town of Burgaz at its head. This gulf is the largest indentation in the Bulgarian coast and the only part of the west shore of the Black Sea which affords several good anchorages. (Figure III-18.)

The Gulf of Burgaz is encircled by a chain of mountains, the summits of which form excellent landmarks, the most conspicuous being Mount Bekerli (Ayu Dag), 1,330 feet high, about 5 miles west of Cape Zeitin. From the northeast it appears as a double peak, from the southeast, seen over the cape, it has a rounded summit. Farther to the southeast there is a saddle-shaped mountain. Inland, a ridge with five peaks, of which the two westernmost are particularly conspicuous, extends a considerable distance; the most westerly is pointed and sharply divided from the adjacent one, and all five are clearly seen when approaching the bay from the northeast.

Muris Dag, conical in form, is situated at the head of the bay and is an excellent mark; it appears as an island when first seen from the east, and is the highest of three mountains adjoining the valley at the head of the bay. The other two mountains are also conical; one is seen behind the north slope of Muris Dag, and the other, known as Mount Foros (Poros), lies southeast of Muris Dag.

A wooded range extends along the north shore of the bay; this range terminates to the eastward in four peaks with pointed summits named Daghutli, which are easily recognized. At the western extreme of this range three remarkable peaks are seen and some distance farther to the west is a fourth, which is completely isolated.

Mount St. Elias, 9 miles northeast of the Daghutli group, is 1,286 feet high. Mount Emine, above the cape of that name, is 1,257 feet high, fairly round and covered with trees; it forms a conspicuous landmark, and is visible from a distance of nearly 40 miles in clear weather.

(2) *Anchorage area.* There is anchorage also in the northern part of Dyavolski Bay with the vessel's stern secured to the shore, in about 4 fathoms, between the reef which extends off Zunaritsa Point and the beach which forms the northern shore. The sea sometimes sets in during fresh southeasterly winds, but these are neither severe nor of long duration. Care should be taken when approaching this anchorage to avoid a long flat shelf of sunken rocks which extends southward from the second prominence westward of Zunaritsa Point; a vessel should, after passing southward off the reef of Zunaritsa Point, continue westward and not haul up for the anchorage until the end of the beach bears 324° true.

(a) *Kara Agatch Cove.* Small craft with local knowledge can find well-sheltered anchorage, in depths of about 4 fathoms, abreast a stream in the northern part of this cove, with a stern hawser laid out to the shore. The approach to this anchorage is from southward, and a vessel should proceed very slowly along the western shore before standing in for the anchorage.

(b) *Dyavolski (Athanatos) Bay.* Small craft with local knowledge can find anchorage in this bay, which should be entered with the point on its western shore, bearing 293° true. There is room for several small vessels, with their sterns secured to the shore, in depths of from 4 to 5 fathoms, in a small bight between the cliffs westward of Nos At Liman (Athanatos Point). A creek, about 130 feet wide, forms a part of the bight; its entrance is narrow but there is much more room within it. A vessel proceeding to this bight should, on opening it out, steer for it when it bears 180° true.

(3) *Dangers to navigation.*

(a) *Kara Agatch Cove.* A sunken reef extends about 1 mile southeast from it.

(b) *Dyavolski (Athanatos) Bay.* A sunken reef, on which there are some above-water rocks, extends about 300 yards northward from Athanatos Point, and a similar reef, which partly shelters the anchorage, extends about the same distance south-southeastward of Zunaritsa Point.

(c) *Cape Zeitin.* This cape is fringed with sunken rocks and should be given a berth of at least 600 yards.

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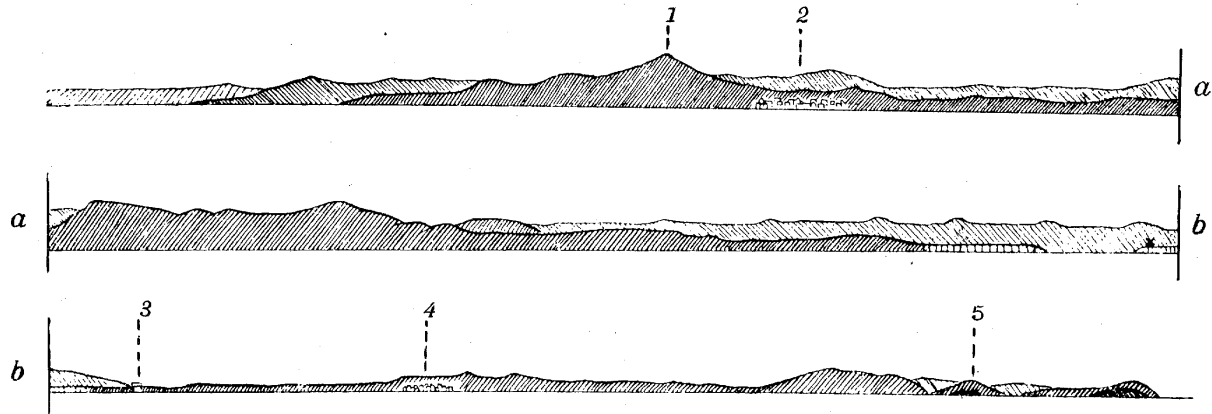


Illustration III-5. Mt. Paphia to Cape Zeitin.
1. Mt. Paphia, 222°, 10 mi.; 2. Tsarevo; 3. White house; 4. Kara Agatch Village; 5. Cape Zeitin.

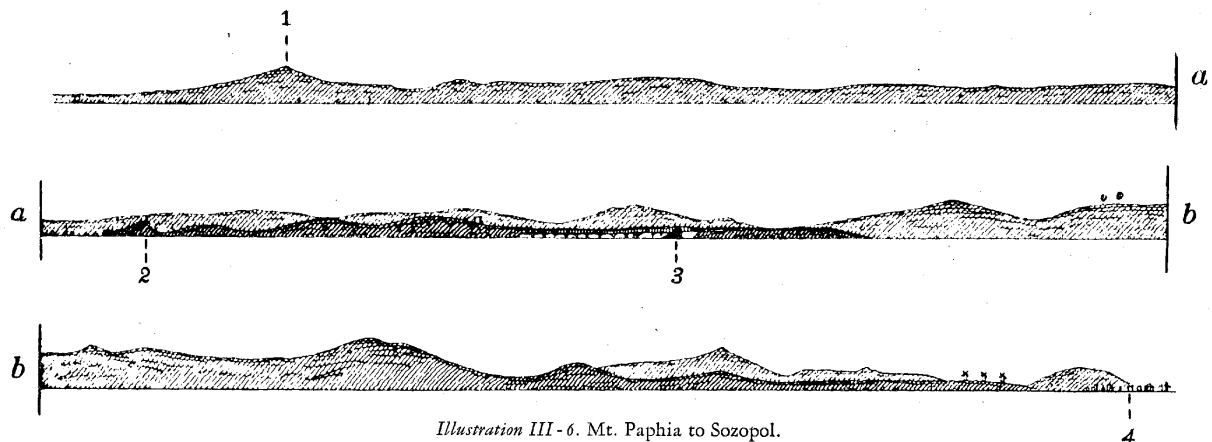


Illustration III-6. Mt. Paphia to Sozopol.
1. Mt. Paphia, 187°, 17 mi.; 2. Cape Zeitin, 218°, 7 mi.; 3. Small black ravine; 4. Sozopol, 285°, 9 mi.

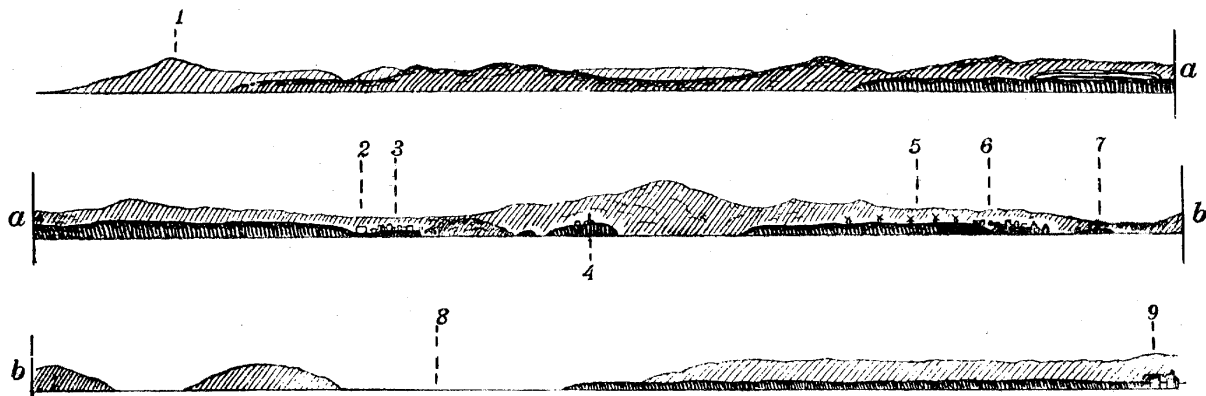


Illustration III-7. Burgaz Gulf.
1. Mt. Paphia; 2. Large white house; 3. Sozopol; 4. Sv. Ivan I. with lighthouse; 5. Windmills; 6. Village;
7. Nos Ativolos; 8. Channel to Burgaz Harbor; 9. Pomoriye.

D. Gulf of Burgaz; Cape Zeitin to Sozopol.

(1) *Coastal description.* Three promontories project from the coast between Cape Zeitin and the town of Sozopol (Sizepoli), forming four small bays which are exposed to the prevailing winds and therefore seldom visited. The promontory immediately to the north of Cape Zeitin is Baghlar Point (Nos Kuratan), previously referred to above. The two other points, Nos Sveta Agalina and Kolokythes (St. Stefan), are low and sandy, the latter being a tongue of land nearly one mile in length. It forms the north side of Kavak Bay, which is the most important of the four bays and is occasionally used as an anchorage.

Kavopithema (Cape Pribachi) is about $1\frac{1}{2}$ miles northwest of Kolokythes and forms the northwest limit of Akroteri and Kalpithes Bays (Illustration III - 9), which lie between these two points. Kavopithema, on which the town of Sozopol is built, is a small, steep peninsula, joined to the mainland, which is high, by a low, sandy isthmus.

(2) *Anchorage area.*

(a) *Kavak Bay.* Good anchorage can be obtained, during summer, off Kavak Bay, about $1\frac{1}{2}$ miles offshore in depths of from 18 to 20 fathoms, mud. A large vessel should anchor with the northern end of the bay bearing less than 360° true.

(3) *Dangers to navigation.*

(a) *Kavak Bay.* Some above-water rocks lie about 400 yards southward of the northern entrance point, otherwise the shore of this bay appears to be bold.

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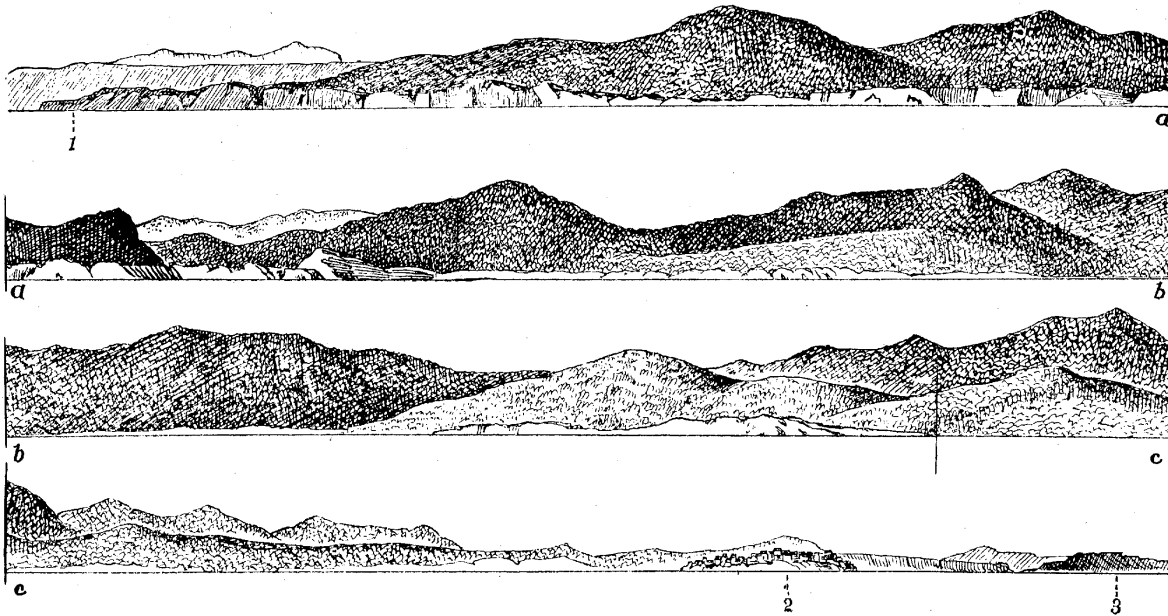


Illustration III - 8. From Cape Zeitin to Sozopol.
1. Cape Zeitin, 206°, 5 mi.; 2. Sozopol, 291°, 7½ mi.; 3. Sv. Ivan I., 297°, 7¼ mi.

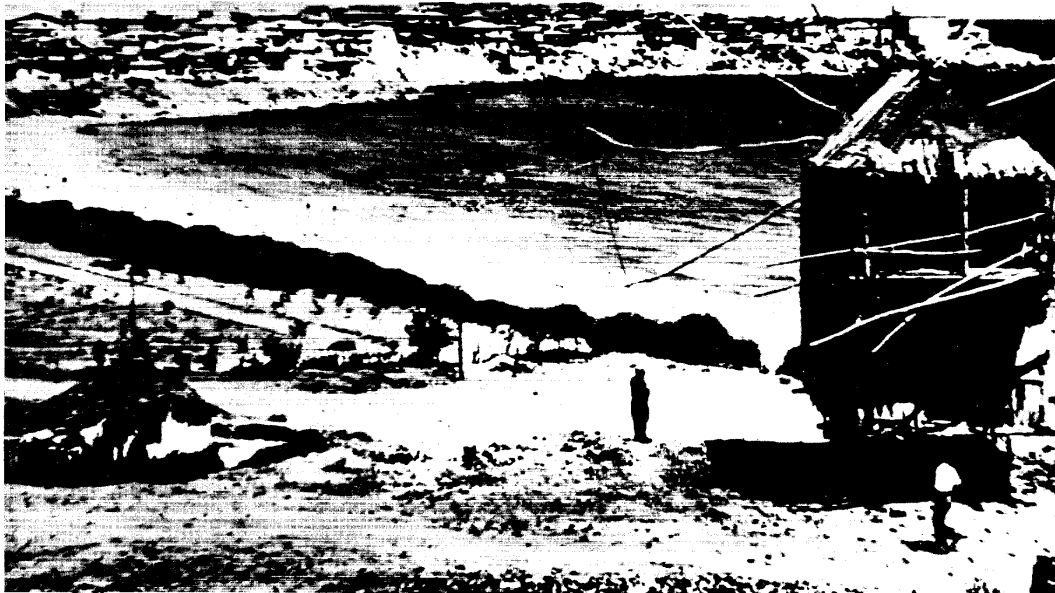


Illustration III - 9. Sozopol, looking northerly across Kalpithes Bay.

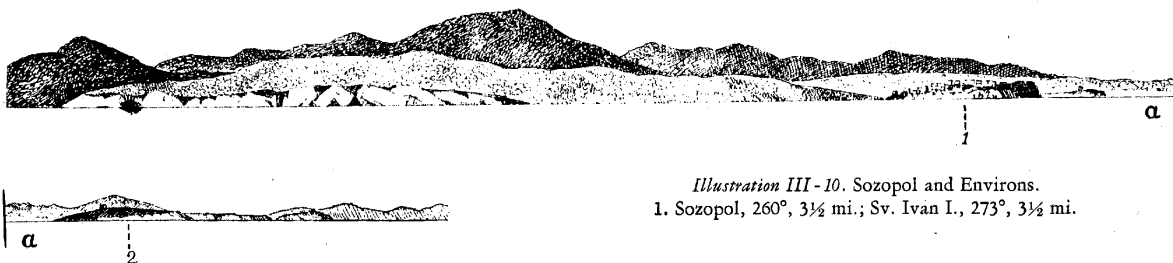


Illustration III - 10. Sozopol and Environs.
1. Sozopol, 260°, 3½ mi.; Sv. Ivan I., 273°, 3½ mi.

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F. Gulf of Burgaz; Kavos Svitera to Nos Sveta Anastasiya.

(1) *Coastal description.* Nos Talasakra (Kavos Nikolo), about $1\frac{1}{4}$ miles north of Kavos Svitera, is bold to approach; a bay is formed between it and Nos Ativolos (Cape Akin), which is $1\frac{1}{4}$ miles to the northwest, and on the southeast side of this bay lies the town of Sveti Nikola (Agios Nikolo). Nos Ativolos is formed by a single bare hill with a remarkable tree on its summit.

Nos Atiya (Monopetra Athia Kavo), about 2 miles west of Nos Ativolos, may be easily distinguished by an isolated, rounded hill, covered with trees, which rises $\frac{1}{2}$ mile south of its extremity. The bay between these two points is $2\frac{3}{4}$ miles wide and open to the north.

Nos Sveta Anastasiya (Sukala Point), about 2 miles west of Nos Atiya, is the middle one of three closely adjacent points; it is high and rises to a wooded, saddle-shaped hill, the cleft between the summits being bare and visible from a considerable distance to the eastward. Athia Bay, open to the north, lies between Nos Atiya and Nos Sveta Anastasiya and is two miles wide. Buffos Point, about 600 yards east of Nos Sveta Anastasiya, rises to a hill on the summit of which stands a monastery. The rocky islet of Sveta Anastasiya, 80 feet high, lies 1,600 yards northeast of Nos Sveta Anastasiya and is only 250 yards long by 100 yards wide. A lighthouse stands near its summit.

(2) *Anchorage area.*

(a) *Nos Ativolos (Cape Akin).* Safe and sheltered anchorage can be obtained in the bay westward of Nos Ativolos, in depths of from 5 to 9 fathoms; care should be taken to avoid the 9-foot shoal in the western part of the bay.

(3) *Dangers to navigation.*

(a) *Nos Ativolos (Cape Akin).* A rocky shoal, on which there are several above-water rocks, lies about 400 yards northeastward of Nos Ativolos. There is a narrow passage, in which there are depths of 8 fathoms, between this shoal and the cape. This shoal is covered by the red sector of Anastasiya light between the bearings of 270° and 312° true.

(b) *Nos Atiya (Monopetra Athia Kavo).* This point is fringed by above-water and sunken rocks. About 1,800 yards to the southeastward and about 600 yards offshore there is a shoal with a least depth of 9 feet.

(c) *Athia (Atiya) Bay.* This bay lies between Nos Atiya and Nos Sveta Anastasiya. The western part of the bay is encumbered with shoals, with depths of less than 3 fathoms, which extend as much as 800 yards offshore; among these shoals is a rock, with a depth of 4 feet over it, situated 700 yards eastward of Buffos Point.

(d) *Nos Sveta Anastasiya (Sukala Point).* Foul ground extends about 500 yards off this point.

(e) *Sveta Anastasiya Island.* This islet is surrounded by a shallow flat which extends as much as 200 yards off its southeastern side.

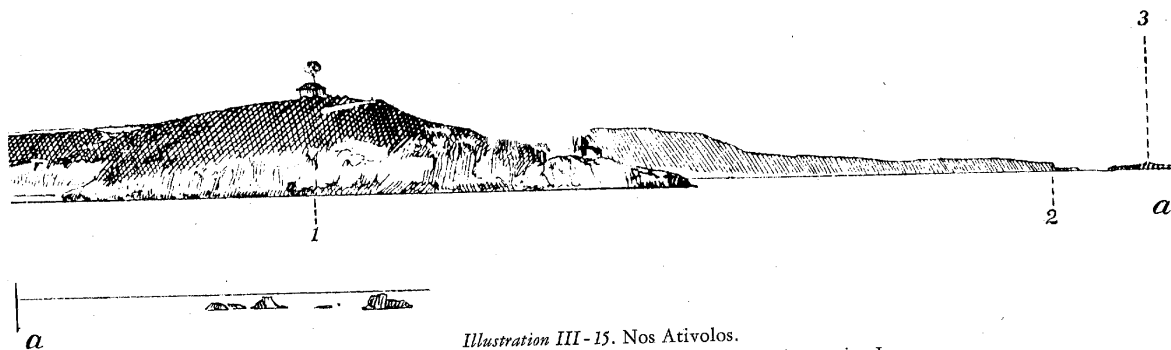


Illustration III-16. Nos Atiya, 276°, 800 yds., and Sveta Anastasiya I., 278°, 2.2 mi.



Illustration III-17. Sveta Anastasiya I., 235°, 600 yds., and Muris Dagh (1).

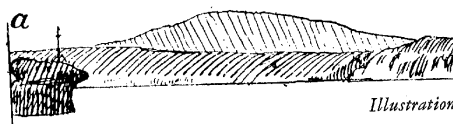


Illustration III-18. Sveta Anastasiya I., 200°, 400 yds.

G. Gulf of Burgaz; Nos Sveta Anastasiya to Burgaz.

(1) *Coastal description.* Between Nos Sveta Anastasiya and Nos Foros (Poros Point), a little over $2\frac{1}{2}$ miles to the westward, lies Chengene Skele (Chingani) Bay which extends into the land for a distance of about $1\frac{3}{4}$ miles. Two small streams empty into the bay near its head, the one to the eastward having a landing place for small boats, with a few sheds and storehouses (reported to be abandoned in winter). The shores of the bay are largely composed of rocky cliffs, interrupted by short stretches of sandy beach. In a small cove on the west shore, about $1\frac{1}{4}$ miles southeast of Nos Foros, there is a quarantine station, consisting of a pier and some houses with a flagstaff in front of them. Nos Foros is a barren tongue of land, recognizable by its steep, whitish slope marked by a white beacon.

Foros Bay lies between Nos Foros and the coast to the westward and is connected by a channel with Lake Mandrensko (Akrianu Geul), a lagoon to the southward. The western shore of Foros Bay, which runs practically north and south is a narrow, low, sandy beach covered with reefs. It separates Lake Vaya-Koi (Muris Geul), a large lagoon 5 miles long by 2 miles wide, on the west from the bay on the east and extends northward to the highland of which the town of Burgaz is built. This beach is only 200 yards in width at its northern end, near which stands a windmill, plainly visible from the bay to the eastward.

The harbor of Burgaz, at the head of the Bay of Burgaz, is formed by two breakwaters. The eastern one, starting from Burgaz Point, extends southeast by south and south for a total distance of 1,220 yards. The western one, on which there are several oil tanks, starts from Orchard Point, about 1,000 yards west of Burgaz Point, and extends south-southeast for 780 yards, then east for 750 yards. A short arm extends from the eastern toward the western breakwater, leaving an entrance about 200 yards wide. The enclosed harbor covers an area of about 1,200 by 600 yards. A lighthouse is located at the end of each of the breakwaters.

(2) Anchorage area.

(a) *Chengene Skele (Chingani) Bay.* Vessels seeking shelter in the Gulf of Burgaz generally anchor in Chengene Skele (Chingani) Bay, which is sheltered from all winds. The nature of the bottom is mud and is good holding ground. A British man-of-war once rode out a strong northeasterly gale here, and found that, although there was a heavy sea in the Bay of Burgaz, little or no swell was found inside a line joining the entrance points of the bays on the southern side of the gulf, and that boats could land at all times.

(b) *Burgaz Harbor.* A vessel of deep draft can find anchorage in depths of from 6 to $6\frac{1}{2}$ fathoms southeastward of the entrance of the harbor. This anchorage is open to the eastward, and winds from that quarter cause a heavy swell and a short sea, and if these become strong, such a vessel should seek shelter in one of the bays on the southern side of the gulf.

(3) Dangers to navigation.

(a) *Nos Foros (Poros Point).* This point is bordered by a rocky reef which extends about 400 yards northward from it.

(b) *Foros (Poros) Bay.* This bay lies between Nos Foros and the coast westward. Within its entrance, the depths in this bay shoal rapidly. A sand flat, which dries, extends about 1,000 yards off its head. A channel, with a depth of about 3 feet over its bar, leads through this flat into Lake Mandrensko (Akrianu Geul), a large lagoon south of the head of the bay, in which there are depths of from 3 to 4 feet.

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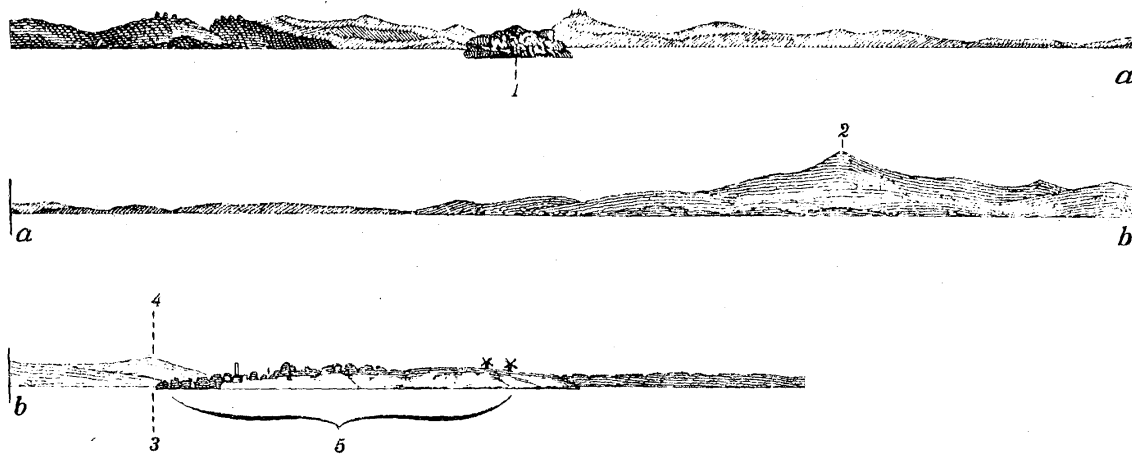


Illustration III-19. Gulf of Burgaz.

1. Sveta Anastasiya I.; 2. Muris Daghi; 3. Burgaz Pt., 261°, in line with hill (4) about 3¾ mi. west of it; 5. Burgaz.

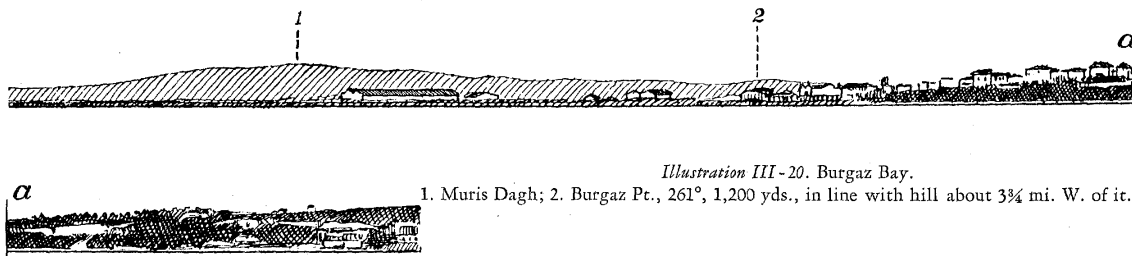


Illustration III-20. Burgaz Bay.

1. Muris Daghi; 2. Burgaz Pt., 261°, 1,200 yds., in line with hill about 3¾ mi. W. of it.

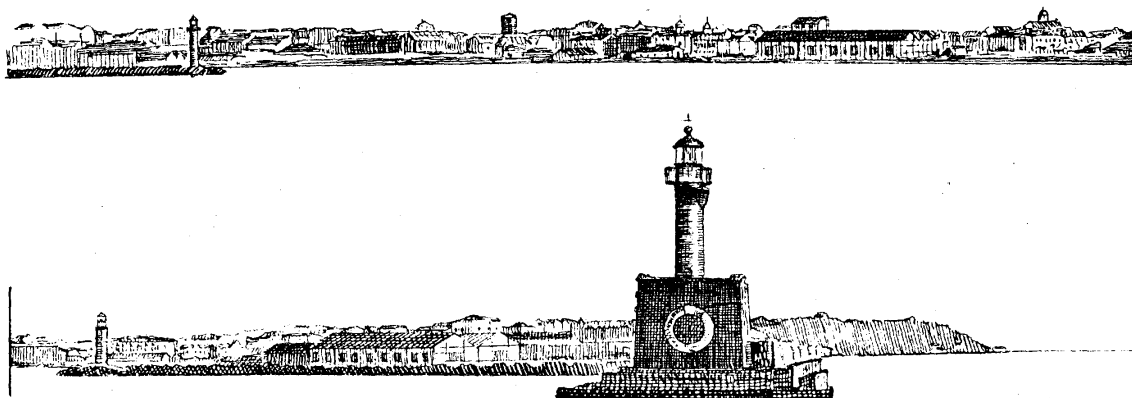


Illustration III-21. Burgaz. Entrance to the harbor.

H. Gulf of Burgaz; Burgaz to Pomoriye.

(1) *Coastal description.* From Burgaz the coast continues to the northward, with cliffs extending for $\frac{3}{4}$ mile, followed by a 2-mile stretch of low, sandy isthmus, about 200 yards wide, which gradually curves to the northeastward and separates the Gulf of Burgaz on the east from Lake Atanaskoi (Athanas Geul), a large lagoon about 5 miles long and 1 mile wide, on the west. The coast rises in cliffs which extend to Cape Lakanathes and bends to the eastward in three arcs, forming three small bays, each about $1\frac{1}{2}$ miles wide. The middle one, known as Lakanathes Bay, lies between Cape Lakanathes to the westward and Red Cliff (Krotiria) Point to the eastward. The coast is backed by the parallel mountain range which ends in the four cone-shaped Daghutli Mountains, easily recognized when approaching from the southeast. Red Cliff Point is lower than Cape Lakanathes and may be identified by a remarkable M-shaped dune. From Cape Lakanathes to the eastward the shore is low and sandy with scattered dunes.

About 2 miles to the east of Red Cliff Point is a steep and rocky peninsula connected to the mainland by a low tongue of sand. Spread along the cliffs at the end of the peninsula, stands the town of Pomoriye (Ankhele). A Byzantine church, at the eastern extremity of the peninsula, and a four-storied building, about one mile northwest of the town, are conspicuous landmarks.

(2) Anchorage area.

(a) *Pomoriye (Ankhele).* During northeasterly winds there is safe anchorage in the western part of the bight westward of the town of Pomoriye, in depths of from 4 to 5 fathoms, sand, from 400 to 600 yards offshore. Anchorage can also be obtained farther southwestward, in depths of from 6 to 7 fathoms, but this anchorage is exposed to easterly and southeasterly winds.

(3) Dangers to navigation.

(a) *Burgaz Shoals.* These shoals, consisting of a number of rocky patches, extend about 1 mile eastward of Burgaz Point. The outermost of these patches has depths of from $3\frac{3}{4}$ to $4\frac{3}{4}$ fathoms, and the least depth lies about 1,750 yards east-northeastward of the lighthouse on the outer end of the eastern breakwater; between this patch and the shore there are several patches with depths of from 2 to 3 fathoms. Daghutli peaks, in line with a tumulus on the northern side of the Gulf of Burgaz, bearing 016° true, lead eastward of these shoals in depths of about 8 fathoms. A spar buoy, surmounted by an upturned broom, is moored off the eastern side of Burgaz Shoals, about $1\frac{1}{2}$ miles eastward of Burgaz Point.

(b) *Blonde or Burgaz Rock.* This rock, with a least depth of $4\frac{3}{4}$ fathoms over it, lies about $2\frac{3}{4}$ miles northeastward of the lighthouse on the outer end of the eastern breakwater. Muris Dagh, bearing 246° true and open southward of Burgaz Point, leads close southward of this rock. The light at the head of the eastern breakwater at Burgaz is obscured over this rock.

(c) *Spiritfire Rock.* This rock, with a least depth of 3 fathoms over it, lies about $4\frac{1}{2}$ miles east-northeastward of the lighthouse on the outer extremity of the eastern breakwater of Burgaz Harbor. Cape Emine, bearing 051° true and open southeastward of the peninsula on which is the town of Pomoriye (Ankhele), leads southeastward of this rock.

(d) *Soka Shoals.* These shoals, consisting of some rocky patches with depths of from 2 to 3 fathoms over them, lie about 1 mile off the shore of the bight, about 2 miles westward of Lakanathes Rock.

(e) *Lakanathes Rock.* This rock, with a least depth of 3 fathoms over it, lies about one mile offshore, about $3\frac{1}{2}$ miles west-southwestward of the southeastward extremity of the peninsula on which the town of Pomoriye (Ankhele) is situated.

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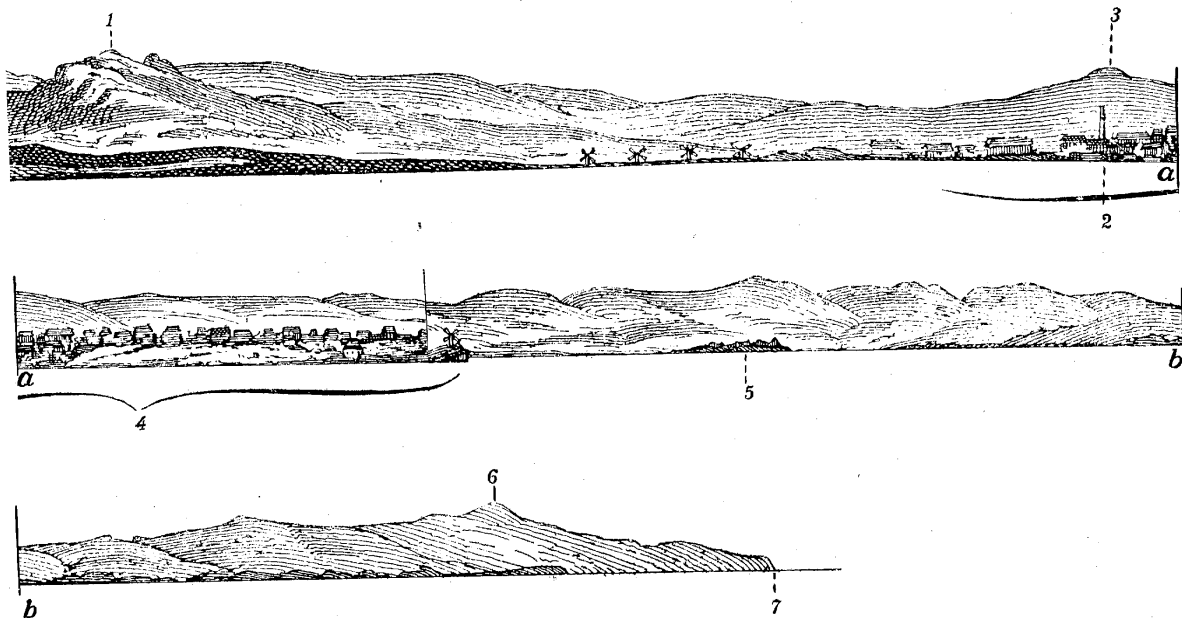


Illustration III-22. North shore of the Gulf of Burgaz.
1. Daghutli Mts.; 2. Bulgarian church at Pomoriye in line with highest peak (3), 2°;
4. Pomoriye (Ankhelu); 5. Nesebr; 6. Mt. Emine; 7. Cape Emine.

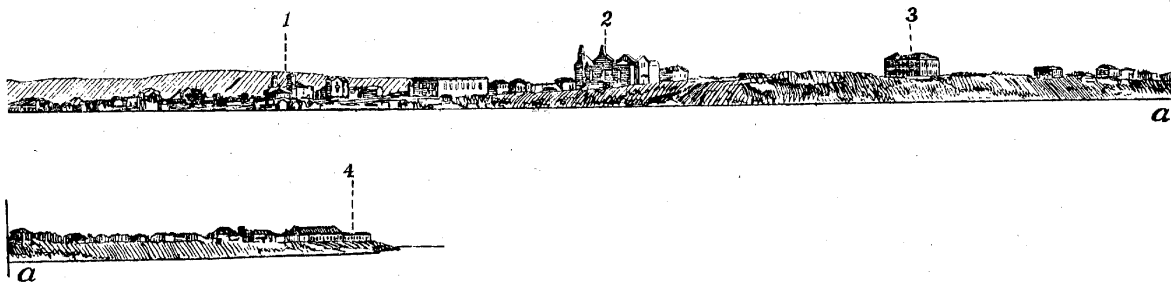


Illustration III-23. Pomoriye (Ankhelu), bearing 0° true, distant 800 yards.
1. Bulgarian church; 2. Greek cathedral (burned); 3. Greek school (burned); 4. Signal station.

I. Gulf of Burgaz; Pomoriye to Ravda Burnu.

(1) *Coastal description.* From Pomoriye the coast trends to the northward and for about 3 miles consists of a low, sandy isthmus, about 200 yards wide, separating the sea on the east from Ankhelu Geul, a salt lake about 3 miles long and $\frac{1}{2}$ mile wide, on the west. About $\frac{3}{4}$ mile north of the lake is the mouth of the Chimovo (Chemose) River, an important stream, and $\frac{3}{4}$ mile farther to the north-east is Chimovo (Chemose) Burnu. From this point the shore, lined with cliffs, extends 1 mile to the eastward to Ravda (Rhavtha) Burnu, a white, rocky point. The villages of Chimovo (Chemose) and Ravda (Rhavtha) are each located about $\frac{1}{2}$ mile to the northward of the point of the same name.

(2) Anchorage area.

(a) *Chimovo (Chemose) River.* During summer there is anchorage in a depth of 6 fathoms, with the mouth of Chimovo River bearing 304° true.

(3) Dangers to navigation.

(a) *Ankbelu Bank.* This bank, with a least depth of $3\frac{1}{4}$ fathoms over it, extends from roughly 1 to $1\frac{1}{2}$ miles southwestward of the extremity of the peninsula of Pomoriye (Ankhelu). The light at the head of the eastern breakwater at Burgaz is obscured over this bank.

(b) *Stavro Rock.* This rock, with a least depth of $2\frac{1}{2}$ fathoms over it, lies about 2 miles southward of the extremity of the peninsula of Pomoriye (Ankhelu). Hill A, bearing 261° true, and open southward of the railway station at Burgaz, leads southward of this rock (see view B on B.A. Chart 2399). The light at the head of the eastern breakwater at Burgaz is obscured over this rock.

(c) *Crescent Shoal.* This shoal, with depths of from $4\frac{1}{2}$ to 5 fathoms over it, lies from 1 to $1\frac{1}{2}$ miles southeastward of the southeastern extremity of the peninsula on which the town of Pomoriye (Ankhelu) is situated. The light at the head of the eastern breakwater at Burgaz is obscured over this shoal.

(d) *Southeast Ankbelu Reef.* This reef extends about $\frac{3}{4}$ mile southeastward of the peninsula of Pomoriye (Ankhelu). On it there is a rocky patch with depths of less than 6 feet. (Figure III - 15.)

(e) *Pomoriye (Ankbelu) Peninsula.* A spit, with depths of 3 fathoms over it, extends about $\frac{3}{4}$ mile west-southwestward of the southern side of the tongue of sand connecting the peninsula to the mainland.

(f) *Northeast Ankbelu Reef.* This reef extends about $1\frac{1}{2}$ miles northeastward of the peninsula of Pomoriye (Ankhelu). On it there are some detached patches with depths of less than 3 fathoms.

(g) *Chimovo (Chemose) Rocks.* These rocks, with depths of from $3\frac{1}{2}$ to 5 fathoms over them, lie about $\frac{3}{4}$ mile offshore and from about $1\frac{1}{2}$ to $2\frac{1}{2}$ miles southward of Chimovo (Chemose) Burnu.

(h) *Ravda (Rhavtha) Rock.* This rock, with a least depth of 3 fathoms over it, lies about $\frac{3}{4}$ mile south-southwestward of Ravda Burnu. The western extremity of the town of Nesebr (Messemvria), bearing 047° true and open southeastward of Cape Krotiriya (Kavo Kroti), leads south-eastward of this rock.

(i) *Ravda (Rhavtha) Burnu.* This white, rocky point, about $1\frac{1}{2}$ miles west-southwestward of Cape Krotiriya (Kavo Kroti), is fringed by a sunken reef which extends about 500 yards offshore.

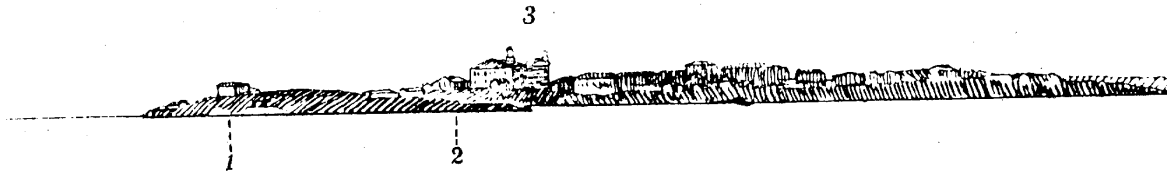


Illustration III-24. Pomoriye (Ankhelu), bearing 270° true, distant 1,200 yards.
1. Signal station; 2. Greek school; 3. Greek cathedral.

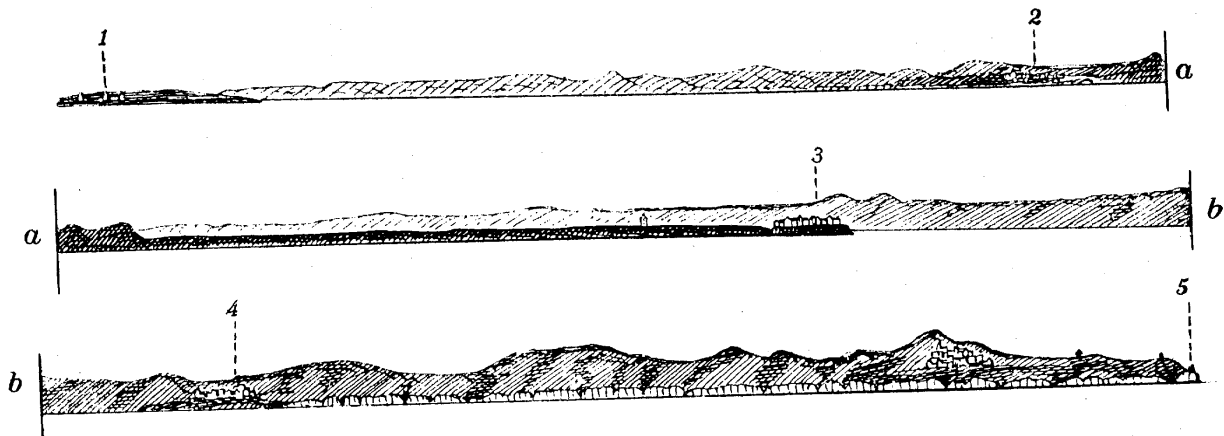


Illustration III-25. North shore of the Gulf of Burgaz.
1. Pomoriye (Ankhelu); 2. Village; 3. Nesebr; 4. Village of Sveti Vlas; 5. Cape Emine.

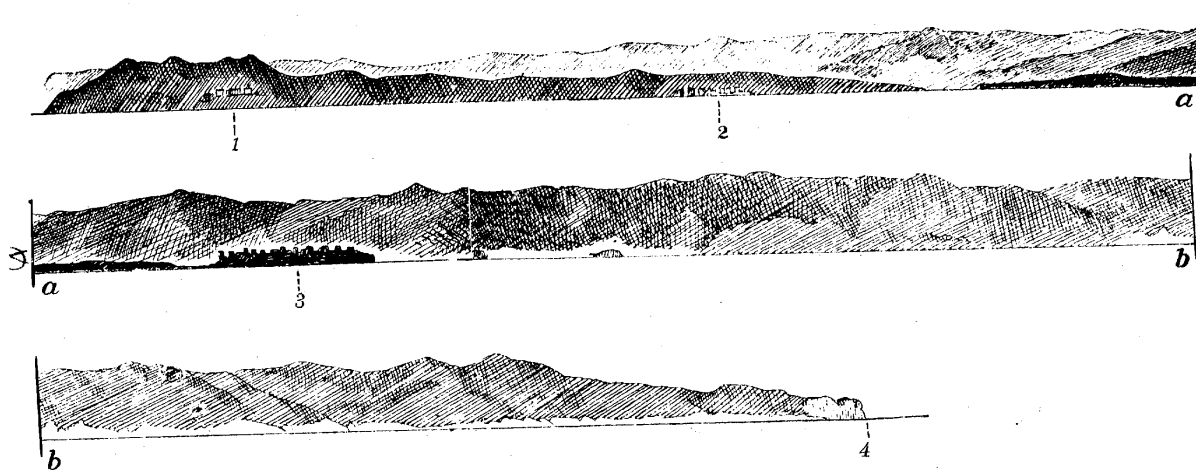


Illustration III-26. From Chimovo to Cape Emine.
1. Chimovo; 2. Ravda, 324°, 9 mi.; 3. Nesebr, 342°, 8¾ mi.; 4. Cape Emine, 22½°, 11½ mi.

J. Gulf of Burgaz; Ravda Burnu to Cape Emine.

(1) *Coastal description.* Cape Krotiriya (Kavo Kroti), a steep, rocky point, is 1½ miles east-north-east of Ravda Burnu, and the low, sandy coast between them curves to the northward, forming a small bay. From Cape Krotiriya a similar but smaller curve extends to the town of Nesebr (Messemvria), one mile to the northeastward. The town occupies the whole of a rocky peninsula, projecting to the eastward and connected to the mainland by a narrow isthmus of sand which is sometimes covered by the sea. (Illustration III - 28.)

From Nesebr the low and sandy coast curves to the northward for about 3 miles, then turns abruptly to the eastward and extends in that direction for about 8 miles to Cape Emine. This stretch, known as the Karedia coast, is high and steep and backed by the wooded heights of a range of mountains.

(2) Dangers to navigation.

(a) *Cape Krotiriya (Kavo Kroti).* This steep, rocky point, lying about 1 mile southwestward of Nesebr (Messemvria), is fringed by a sunken reef which extends as much as 800 yards southwestward from it.

(b) *Nesebr (Messemvria) Peninsula.* This peninsula is fringed by a sunken reef which extends as much as 800 yards eastward from it.

(3) Anchorage area.

(a) *Nesebr (Messemvria).* Anchorage can be obtained southwestward of the town of Nesebr, in depths of from 5 to 8 fathoms, sand and shell, about 800 yards offshore abreast a fountain.

Anchorage can also be obtained northward of the town of Nesebr, in depths of about 7 fathoms, but this anchorage is exposed to the squalls which, during northerly winds, blow violently off the highland back of Cape Emine.

(b) *Cape Emine.* The bay entered between Cape Emine and Nesebr (Messemvria) affords good anchorage in depths of from about 8 to 12 fathoms; it is open between east and south, and vessels usually anchor in its western part. The best anchorage in the eastern part of this bay is in a depth of 9 fathoms, mud, about 1,000 yards offshore and 2½ miles westward of Cape Emine.

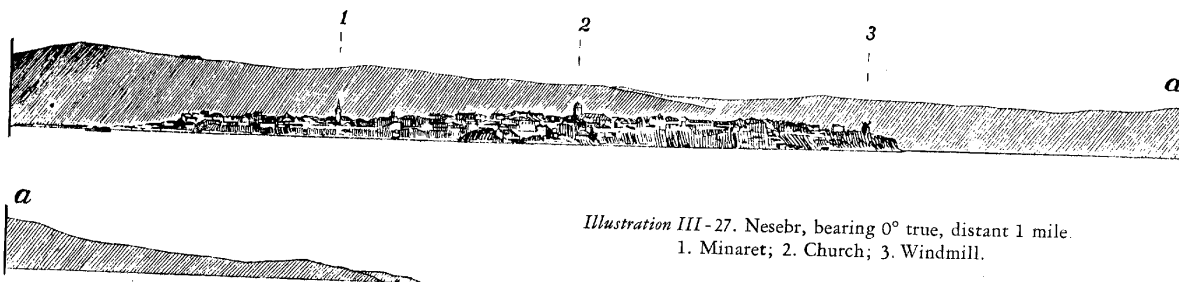


Illustration III-27. Nesebr, bearing 0° true, distant 1 mile.
1. Minaret; 2. Church; 3. Windmill.

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Illustration III-28. Nesebr.
Looking westerly over peninsula and isthmus.

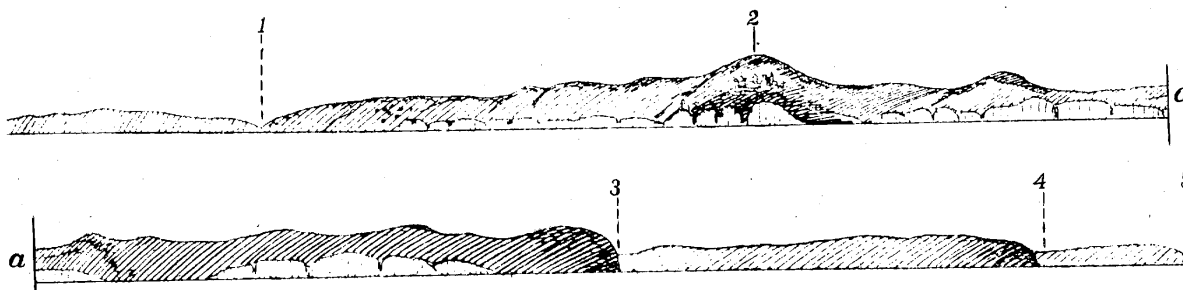


Illustration III-29. From Nesebr to Kara Burnu.
1. Nesebr Bay; 2. Cape Emine, 323°, 5.2 mi.; 3. Kotsan Pt.; 4. Cape Aspro; 5. Kara Burnu.

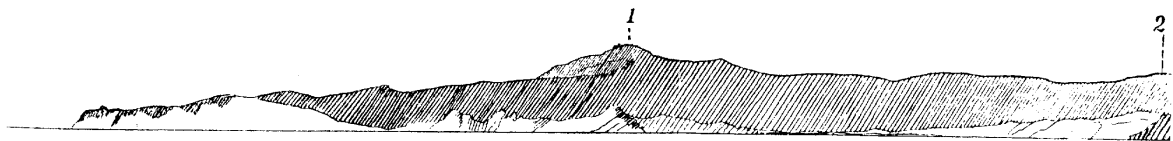


Illustration III-30. Cape Emine, bearing 226° true, distant 10½ miles.
1. Mt. Emine; 2. Kotsan Pt.



Illustration III-31. Cape Emine, bearing 180° true, distant 2 miles.

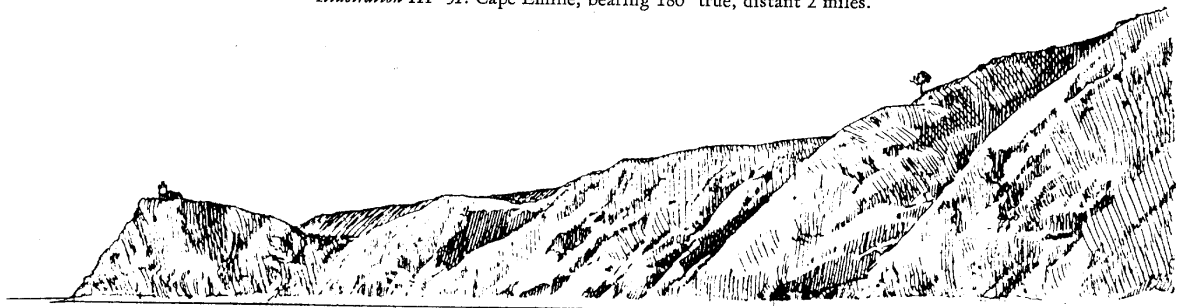


Illustration III-32. Cape Emine, bearing 183° true, distant 1 mile.

K. Cape Emine.

(1) *Coastal description.* Cape Emine is a bold, rocky headland, about 185 feet high, with cliffs rising 120 to 150 feet above the sea. There is a lighthouse on its summit and from the southward the cape appears as an island. It is one of the best landmarks on the entire west coast of the Black Sea. The land slopes steeply inland to the rounded, wooded crest of Mount Emine, 1,257 feet high and 3,400 yards northwest of the cape; 2 hills of similar form, though much lower, appear on both sides of Cape Emine on the bearing of 305° true.

From Emine the coast has a northerly trend and continues in that general direction for about 27 miles to Cape Galata, the southern entrance point of Varna Bay. About 1,300 yards north of Cape Emine, on a high, thickly wooded, rocky slope, stand the white buildings of a monastery, while in the background can be seen the large village of Emine, clinging to the southeast flank of the mountain of that name.

(2) *Dangers to navigation.*

(a) *Cape Emine.* A sunken rocky flat extends about 400 yards eastward from the cape and there are depths of 5 fathoms about 600 yards off it.

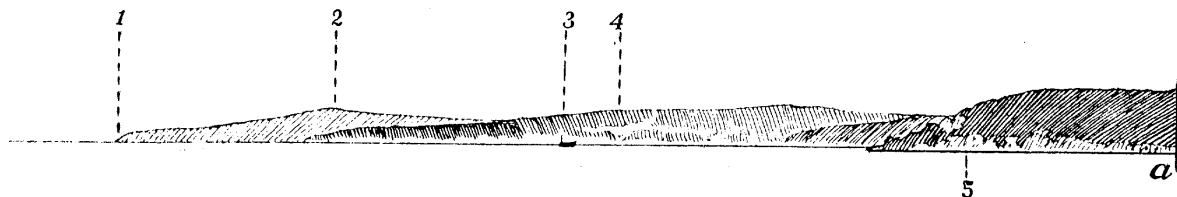
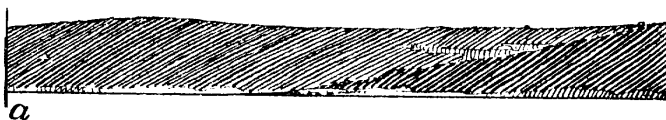


Illustration III-33. From Cape Emine to Kara Burnu.
1. Cape Emine; 2. Mt. Emine; 3. Cape Aspro, with wreck of "Gayret" on Kara Burnu Reef; 4. Village of Bela; 5. Kara Burnu, 215°, 2.2 mi.



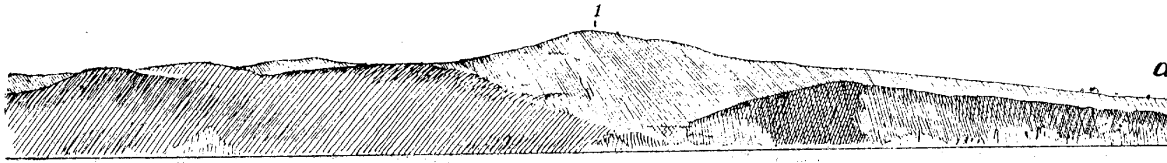


Illustration III-34. Cape Emine, bearing 0° true, distant $2\frac{1}{2}$ miles.
1. Mt. Emine.

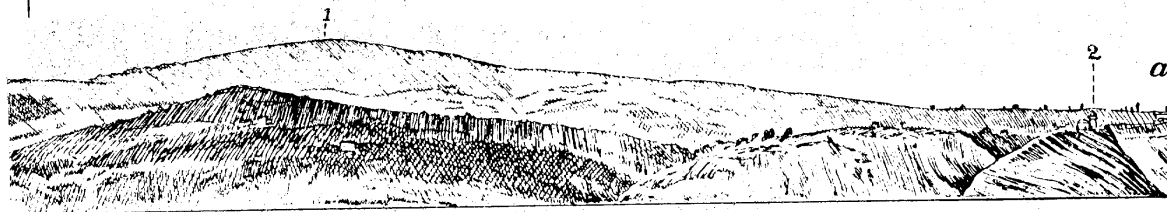


Illustration III-35. Cape Emine, bearing 340° true, distant $1\frac{1}{2}$ miles.
1. Mt. Emine; 2. Cape Emine; 3. Kotsan Pt.

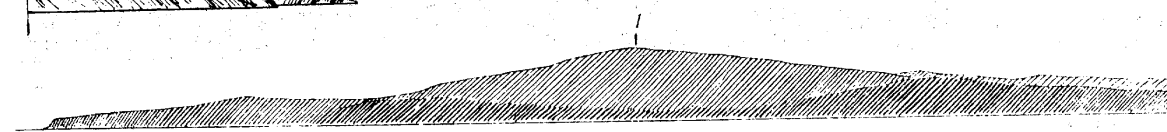


Illustration III-36. Cape Emine, bearing 276° true, distant 1.8 miles.
1. Mt. Emine.

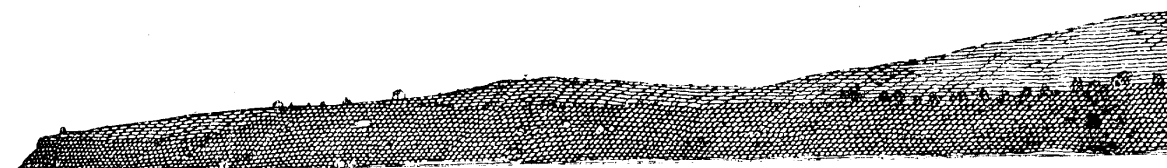


Illustration III-37. Cape Emine, bearing 270° true, distant 2 miles.

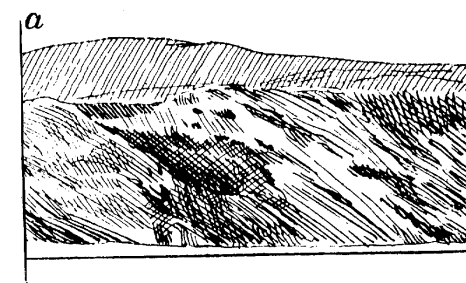
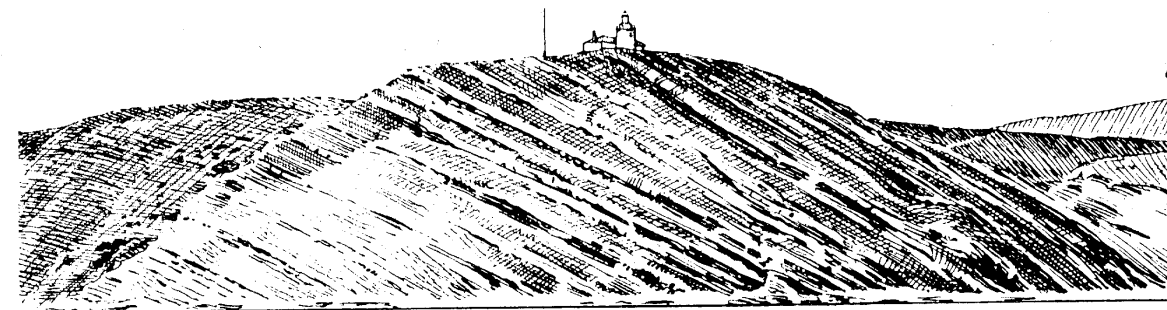


Illustration III-38. Cape Emine, bearing 270° true, distant 1,000 yards.

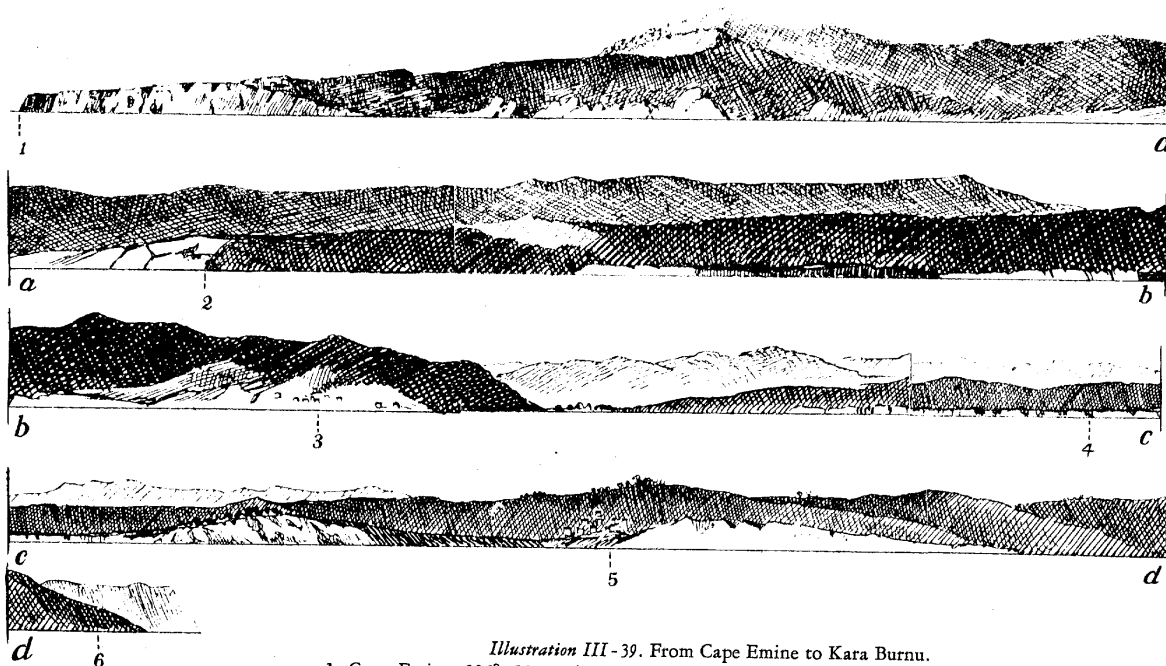


Illustration III-39. From Cape Emine to Kara Burnu.

1. Cape Emine, 226°, 10½ mi.; 2. Kotsan Pt., 247°, 8¼ mi.; 3. Keoscheh, 270°, 8¼ mi.;
4. Cape Aspro, 288°, 8¼ mi.; 5. Village of Bela, 295°, 9 mi.; 6. Kara Burnu, 313°, 10¼ mi.

L. Cape Emine to Cape Aspro.

(1) *Coastal description.* Kotsan Point, about 3½ miles north of Cape Emine, is steep and wooded on its south side. Between this point and Cape Emine there is a sandy valley through which a stream flows at times. North of Kotsan Point the coast is moderately high and wooded and becomes lower toward the mouth of the stream which flows through Keoscheh Valley, about 3½ miles to the north; the village of Obzor (Keoscheh) lies on the south side of the valley and is visible from the offing.

Cape Akdere (Sveti Athanas), about 4 miles north of Kotsan Point, is prominent and has a stone lighthouse and a large clump of trees near its extremity. The village of Bela (Aspro), surrounded by tall poplars and other trees, lies in a valley about 1½ miles northwest of the cape and above the village there is a conspicuous wooded hill; between this valley and Cape Aspro (Ak Burnu), about 2 miles north of Cape Akdere, the coast is white in appearance, but Cape Aspro itself is dark in color and its slopes are covered with trees and brushwood. A white point on the cape may be seen from a considerable distance and is an excellent landmark.

(2) Anchorage area.

(a) *Kotsan Point.* There is anchorage, in fine weather, in depths of from 7 to 10 fathoms, abreast the valley between Cape Emine and Kotsan Point.

(b) *Keoscheh (Djoski).* Anchorage, with some shelter from northwesterly winds, can be obtained in depths of from about 9 to 11 fathoms abreast the village of Keoscheh. The bottom is of sand and small shells or sand and mud.

(3) Dangers to navigation.

(a) *Cape Aspro (Ak Burnu).* Foul ground was reported, in 1880, to extend ¾ mile off this cape. Vessels should not approach within 2 miles of the coast in this vicinity.

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Illustration III - 40. Kotsan Pt., bearing 247° true, distant 8 mi.



Illustration III - 41. Keoscheh, looking westerly.
1. Keoscheh, 270°, 8¼ mi.; 2. Yellowish, gravelly bluffs of Cape Aspro.

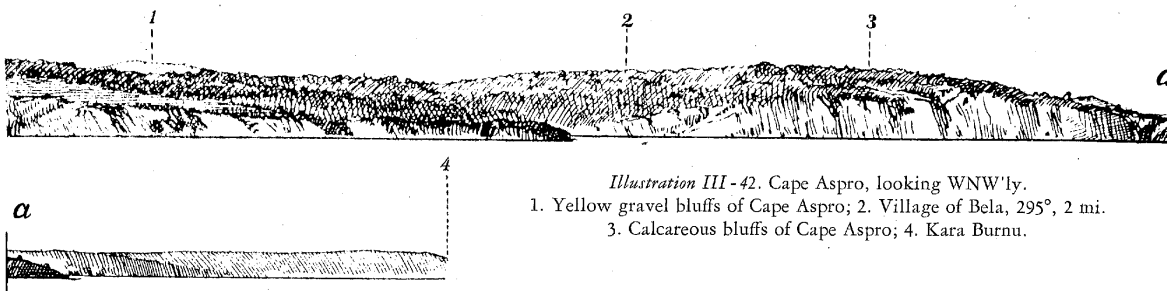


Illustration III - 42. Cape Aspro, looking WNW'ly.
1. Yellow gravel bluffs of Cape Aspro; 2. Village of Bela, 295°, 2 mi.
3. Calcareous bluffs of Cape Aspro; 4. Kara Burnu.



Illustration III - 43. Kara Burnu, looking NW'ly.
1. Gravel bluffs of Cape Aspro; 2. Village of Bela; 3. Calcareous bluffs of Cape Aspro; 4. Kara Burnu, 313°, 10 mi.

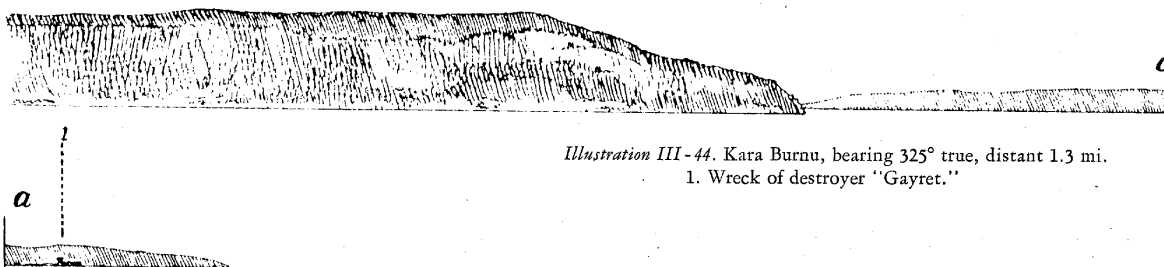


Illustration III - 44. Kara Burnu, bearing 325° true, distant 1.3 mi.
1. Wreck of destroyer "Gayret."

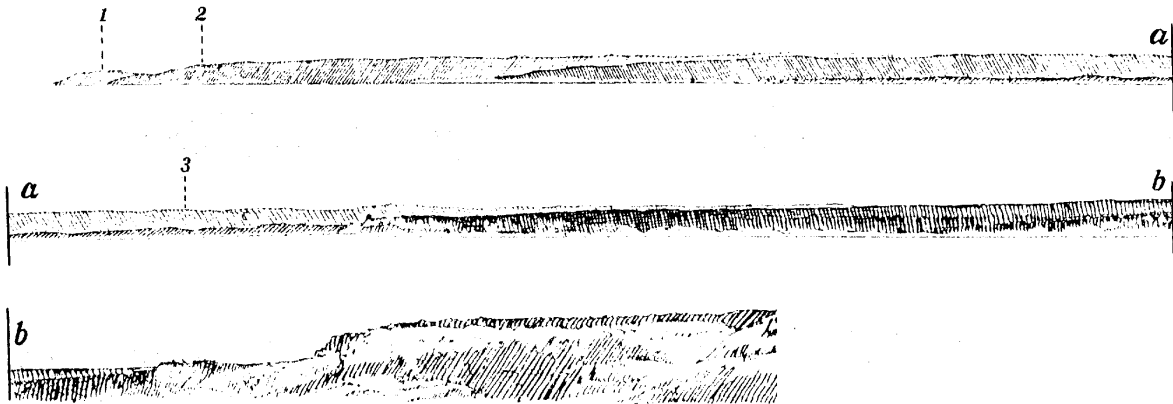


Illustration III-45. Mouth of the Kamchiya River, looking SSW'ly. 1. Mt. Emine; 2. Kara Burnu, 190°, 7 mi. 3. Mouth of Kamchiya (virgin forest).

M. Cape Aspro to Kamchiya River.

(1) *Coastal description.* Kara Burnu (Black Point), about 3 miles north of Cape Aspro, is very dark and covered with trees and underbrush. About 2 miles north of this point the Funduklee (Arnautka) River flows into the sea through a deep valley, and on the sandy beach at its mouth there are a few houses. The Kamchiya River flows into the sea about 3½ miles north of the Funduklee and is a more important stream than the latter. It winds through the northern edge of a broad, wooded plain which here forms a break in the coastal hills and white cliffs; it has a shallow bar but flows throughout the summer. A low hill covered with much brushwood rises a short distance from the north bank of the river. A thick forest grows along the river, supplying large quantities of firewood.

(2) Anchorage area.

(a) *Kamchiya (Kamchy) River.* Good anchorage can be obtained during summer, in a depth of 10 fathoms, mud, about 1¼ miles off the mouth of Kamchiya River. A large vessel should not approach within 1 mile of the river mouth because of a shoal, which is described below.

(3) Dangers to navigation.

(a) *Kamchiya River.* A shoal, consisting of rock and gravel, with depths of 2½ fathoms over it and greater depths within, lies about 1,000 yards off the mouth of this river.

(b) *Kara Burnu.* A rock, with a depth of less than 6 feet over it, lies about ½ mile eastward of this point. Vessels should not approach within 2 miles of the coast in this vicinity.

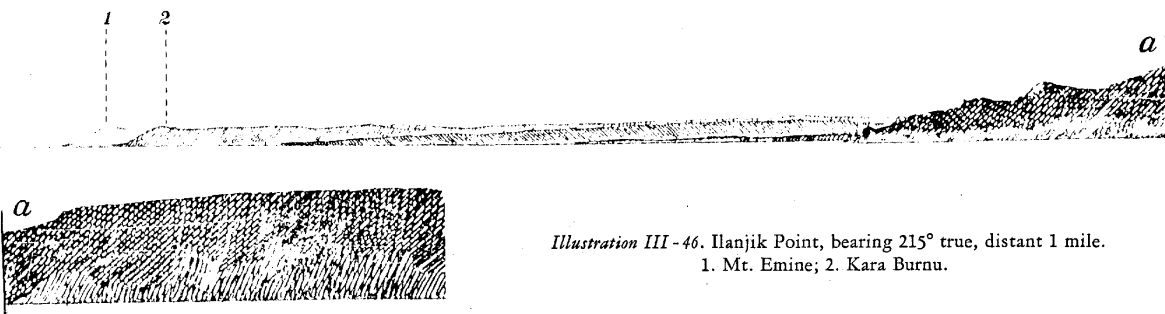


Illustration III-46. Ilanjik Point, bearing 215° true, distant 1 mile.
1. Mt. Emine; 2. Kara Burnu.



Illustration III-47. Cape Galata, bearing 315° true, distant 1 mile.

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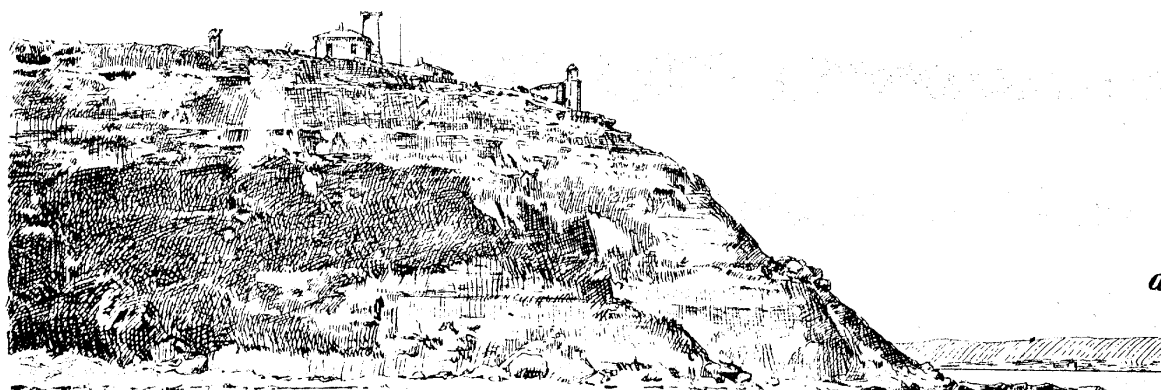


Illustration III-48. Cape Galata, bearing 270° true, distant 400 yards.

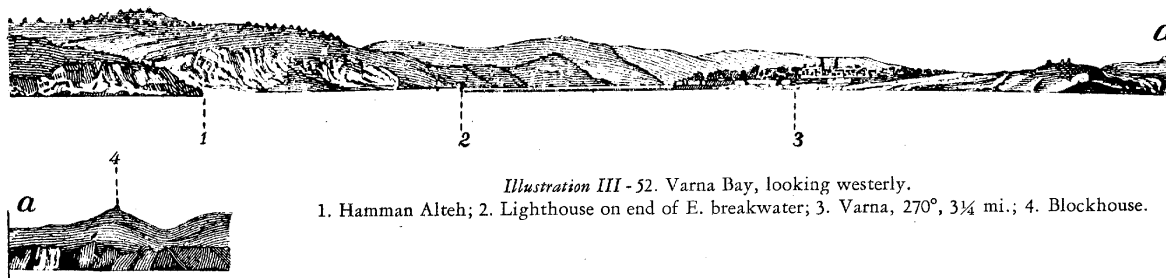
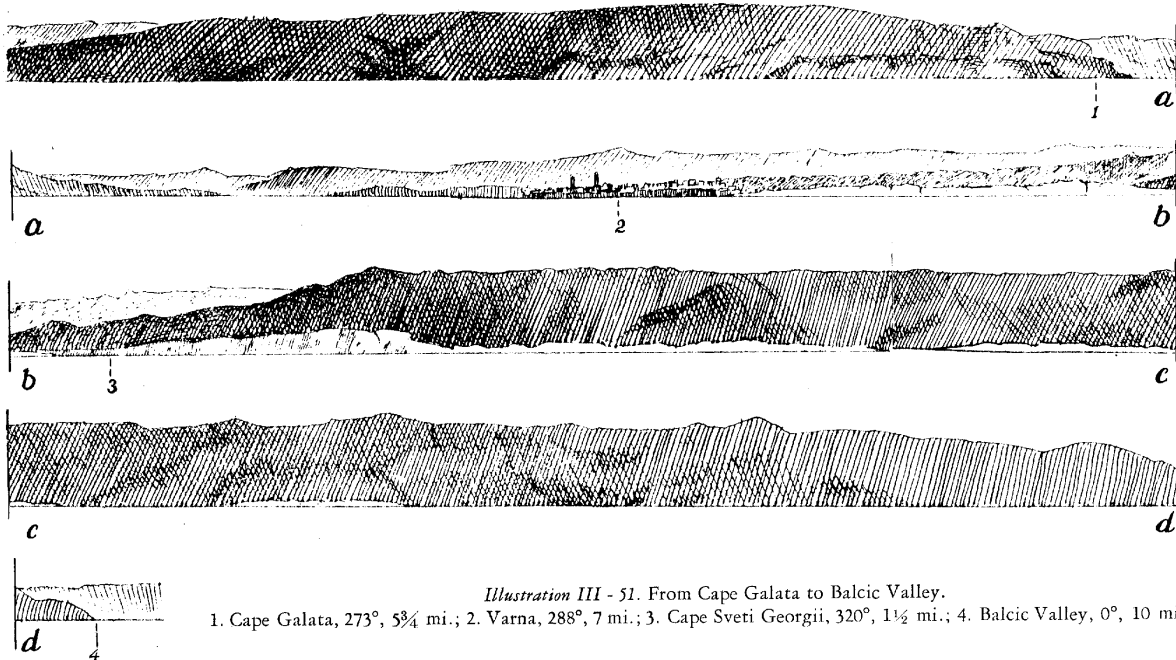
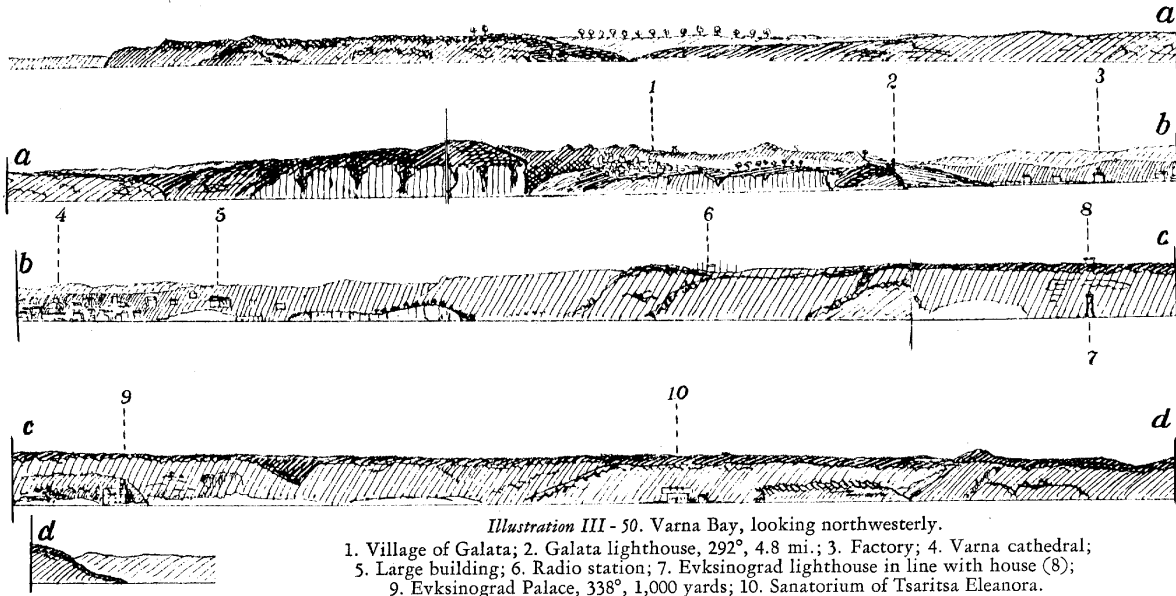


Illustration III-49. Cape Galata, bearing 180° true, distant 1,000 yards.

N. Kamchiya River to Cape Galata.

(1) *Coastal description.* About 2 miles north of the Kamchiya River is Ilanjik Point and 9 miles farther to the north-northeast is Cape Galata, high and steep and covered with cultivated fields which give it a bright color in comparison with the darker tone of the trees which cover the coast to the south. There is a lighthouse on the northeast extremity of the cape and a signal station near it.

At Cape Galata the coast turns abruptly to the west to form Varna Bay, which is entered between Cape Galata and Cape St. George (Sveti Georgii), about 4 miles to the northeast. When approaching from the northeast Cape Galata may be easily identified from a distance of 16 miles, and the land south of the bay appears as a long, narrow ridge with its extremities sloping to the sea; this ridge is much lower than the land to the northward.



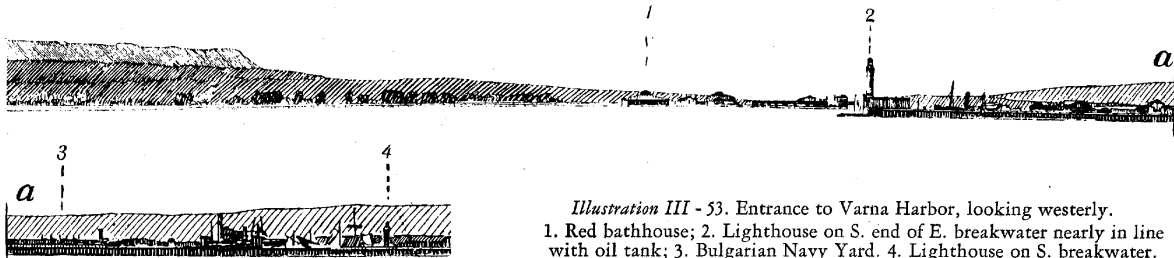


Illustration III - 53. Entrance to Varna Harbor, looking westerly.
1. Red bathhouse; 2. Lighthouse on S. end of E. breakwater nearly in line with oil tank; 3. Bulgarian Navy Yard. 4. Lighthouse on S. breakwater.



Illustration III - 54. Varna.
Entrance to Varna Harbor, looking northeasterly.

O. Varna Bay.

(1) *Coastal description.* Varna Bay is a spacious and well-sheltered anchorage lying at the mouth of the Devna River, which flows from west to east between two parallel mountain ranges. The town and harbor of Varna lie at the northwest side of the head of the bay. Lake Devna, the wide estuary of the Devna River, is situated west of the harbor, from which it is separated by a marshy neck of land about 1 mile in width. The lake is about $5\frac{1}{2}$ miles in length from east to west and from $\frac{1}{2}$ to 1 mile in width; it is connected to the harbor by a canal. (Illustrations III - 54 to III - 61.)

(2) Anchorage area.

(a) *Varna Bay.* Varna Bay affords anchorage, with good holding ground consisting of mud and sand, and is well sheltered from all but easterly winds which, it is reported, are seldom severe or of long duration.

The best anchorage in the bay is eastward of the eastern breakwater, in depths of about 7 fathoms. Fishing nets with stakes are occasionally laid out eastward of the breakwater and extend about 330 yards seaward from it.

(3) Dangers to navigation.

(a) *Hamman Alteh.* About 600 yards northward of this point, in the southern part of Varna Bay, there is an area of foul ground with two shoals with depths of $3\frac{1}{2}$ and $4\frac{1}{4}$ fathoms; there are some other rocks with depths of $4\frac{1}{4}$ fathoms within a distance of about 400 yards from these two shoals. These shoals are so small that it is possible that the least depths over them have not been ascertained; the nature of the bottom in their vicinity appears to be rock, thinly covered with sand.

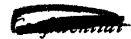


Illustration III-55. Varna Harbor.
Looking northwesterly. (About 1931.)

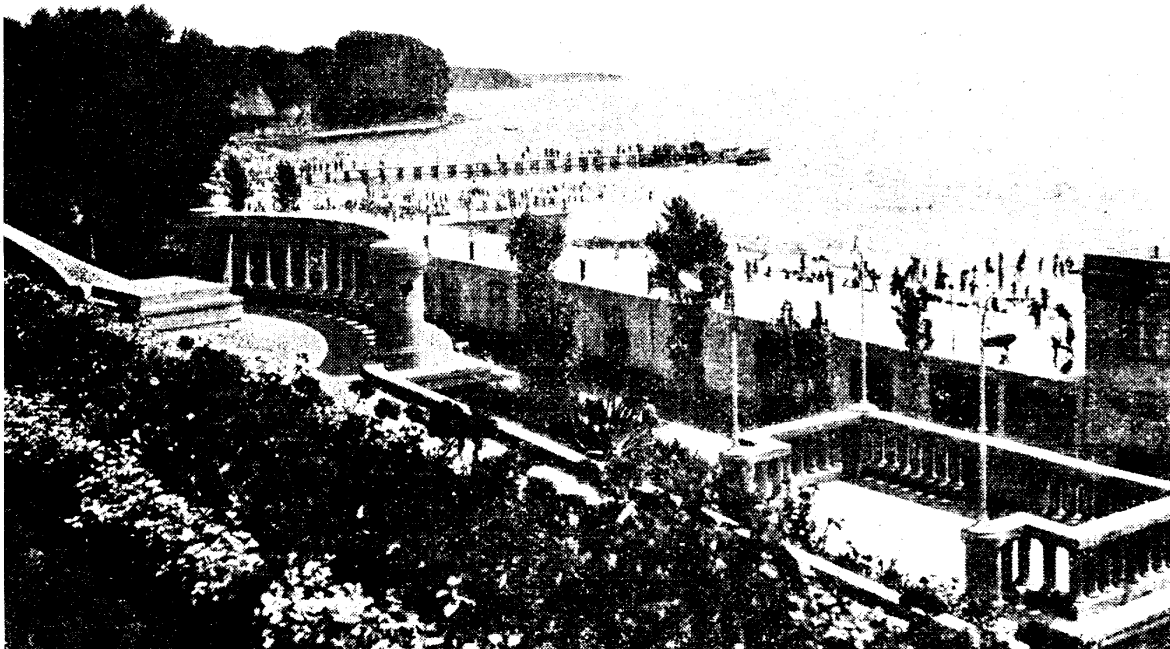


Illustration III-56. Varna.
Looking east-northeasterly from park above bathing beach. Cape Sveti Dimitri in background.



Illustration III - 57. Varna.
Looking east-northeasterly from bathing beach along north shore of Varna Bay.

P. Varna Bay; Cape Galata to Varna.

(1) *Coastal description.* The south side of Varna Bay, extending about 1 mile westward of Cape Galata, is composed of fairly high cliffs, gradually sloping downward toward the west and backed by mountainous land. The western shore, or head of the bay, is a sandy beach, about 1 mile long, extending north to the entrance of the dredged canal and artificial harbor of Varna. The latter is formed by two breakwaters; the eastern one, starting from the southeast corner of the town runs in a southerly direction for 1,350 yards, and has a short arm, 110 yards long on its western side, 500 yards from its outer end and abreast the western breakwater. The western breakwater, starting from the west shore, runs in an easterly direction for 740 yards, leaving an opening 220 yards wide between the two breakwaters. (Illustration III - 54.) A lighthouse stands at the outer end of the eastern breakwater and on each side of the harbor entrance. The area enclosed by the breakwaters measures about 750 by 700 yards. (Illustration III - 55.)

Northeast of Varna Harbor the low shore for about 1,500 yards is occupied by bathing beaches, backed by a park rising in terraces. This is followed by 2 miles of horizontally stratified cliffs, gradually increasing in height from about 60 feet on the west to about 130 feet on the east. On the flat tableland above the cliffs there are many villas and gardens. (Illustrations III - 56 to III - 58.)

(2) *Dangers to navigation.*

Foul ground extends about 550 yards off the northeast shore of Varna City, abreast the cemetery.



Illustration III-58. North shore of Varna Bay.
Looking west-southwesterly. Varna in background.



Illustration III-59. Evksinograd Bay.
Looking easterly. Palace in left background.

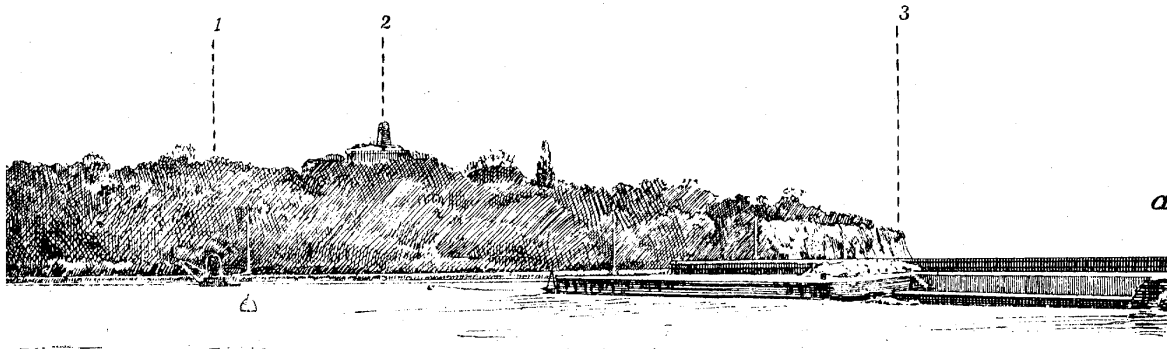


Illustration III - 60. Entrance to Evksinograd Harbor, looking easterly.
1. Landing pier; 2. Evksinograd Palace; 3. Cape Sveti Dimitri.

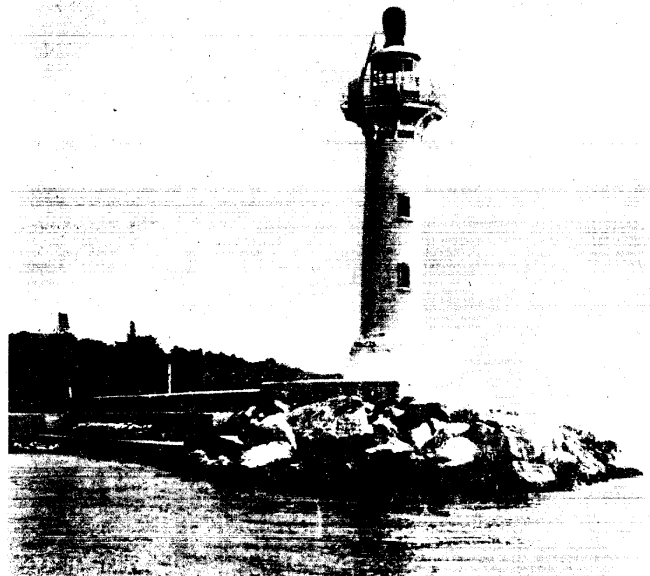
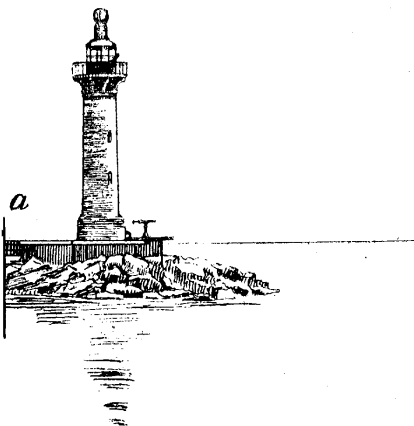
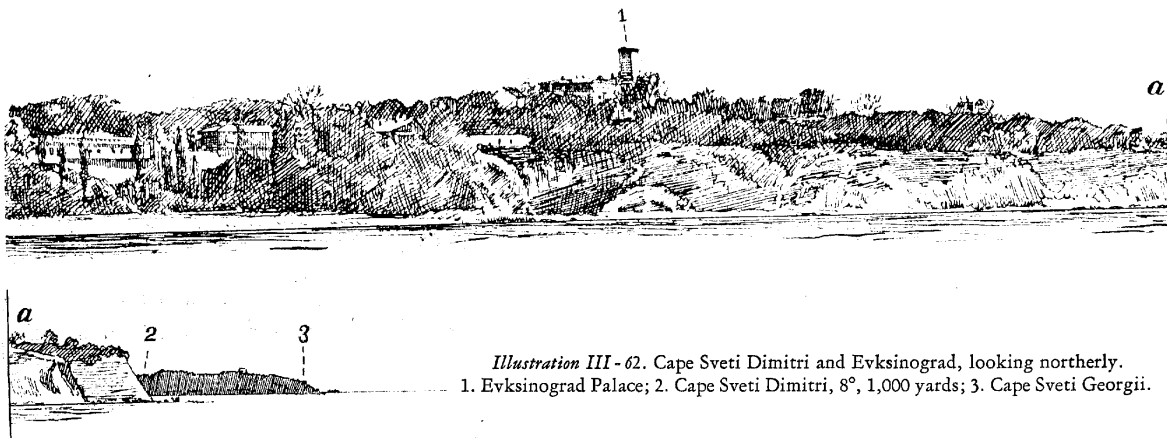


Illustration III - 61. Evksinograd Bay.
Lighthouse on end of breakwater, looking east-northeasterly.

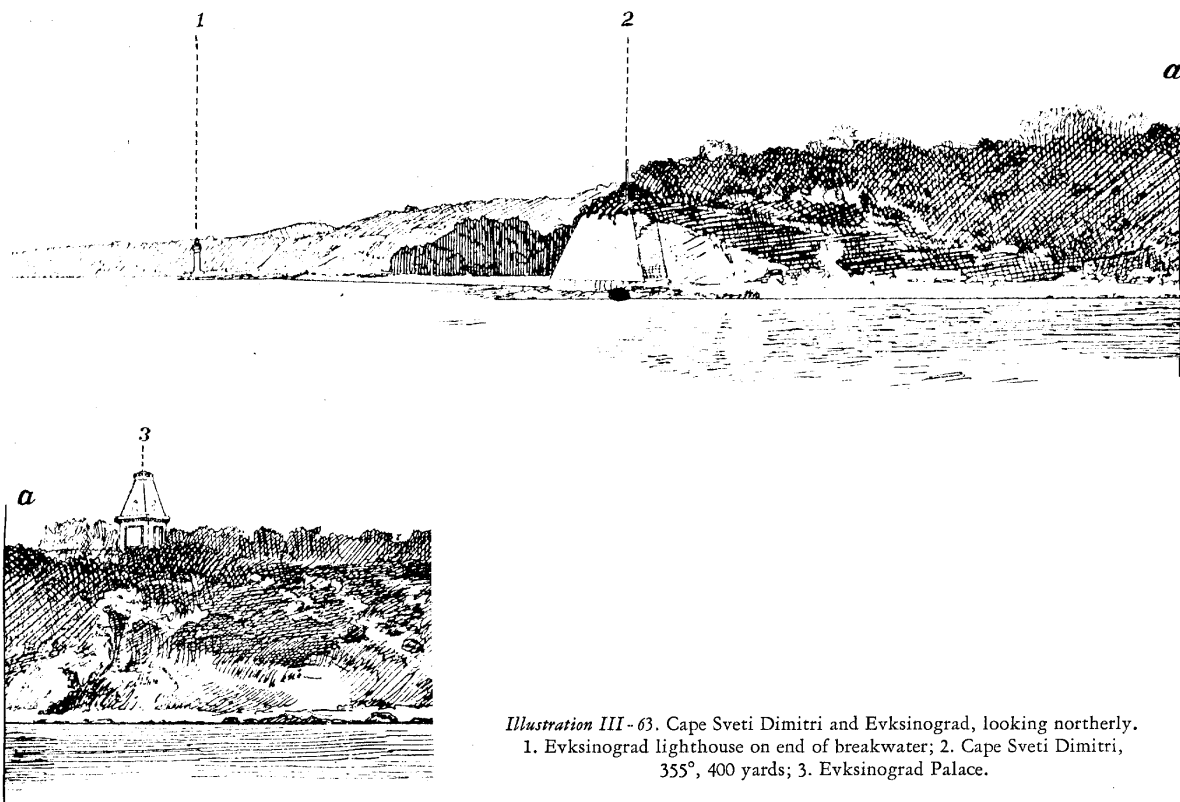
Q. Varna Bay; Varna to Cape Sv. Georgii.

(1) *Coastal description.* Evksinograd (Euxinograd) Bay, about 3 miles east-northeast of Varna, is a small harbor with a breakwater and a landing pier and a sandy beach about $\frac{1}{2}$ mile long. Cape (Sveti Dimitri) St. Demetri, about 500 yards east of Evksinograd Bay, is rocky, with steep reddish cliffs above which stands the palace of Evksinograd, a large building with a conspicuous tower visible for many miles. Cape Sveti Georgii (St. George), 1,200 yards east-northeast of Cape St. Demetri, is rocky and not very high. On its summit stands a monastery which is visible only from the east, being hidden by trees from all other directions.



(2) *Dangers to navigation.*

Cape Sveti Georgii. There are some patches of foul ground as much as 300 yards off the low, cliffy points in the vicinity of this cape and the latter should be given a berth of at least 500 yards.



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OCEANOGRAPHY, COASTAL HYDROGRAPHY, COASTS, LANDING PLACES

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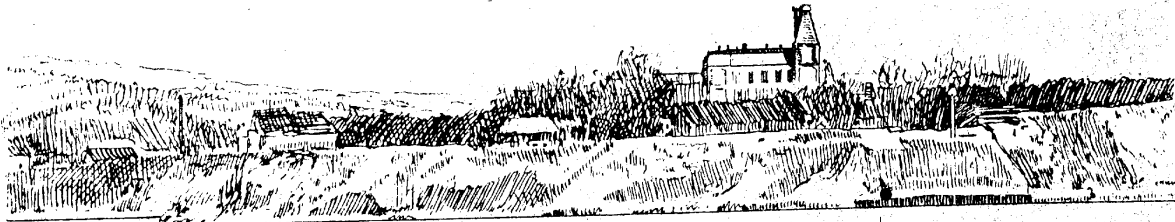


Illustration III-64. Evksinograd, bearing 320° true, distant 1,000 yards.

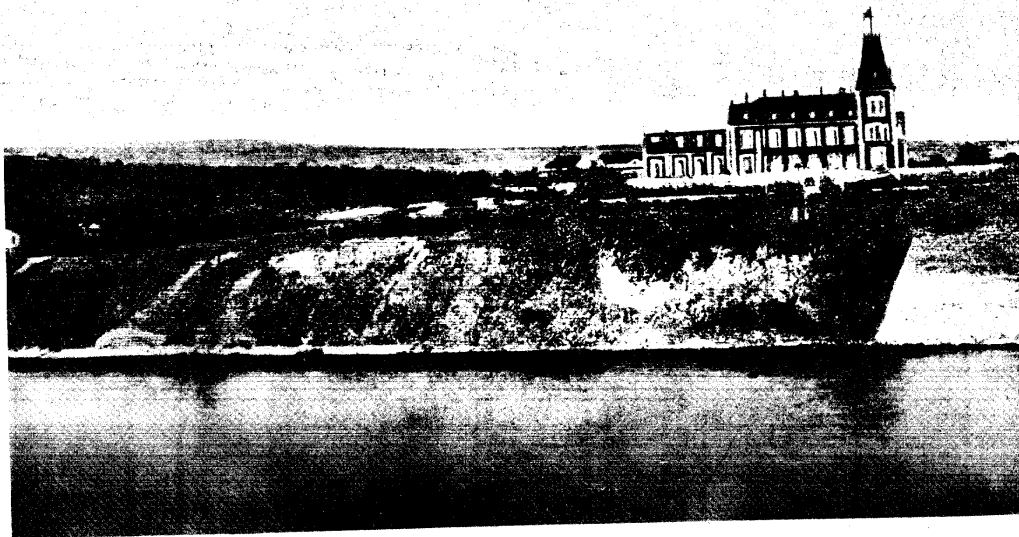


Illustration III-65.
Evksinograd. The Royal Palace, looking northwesterly.

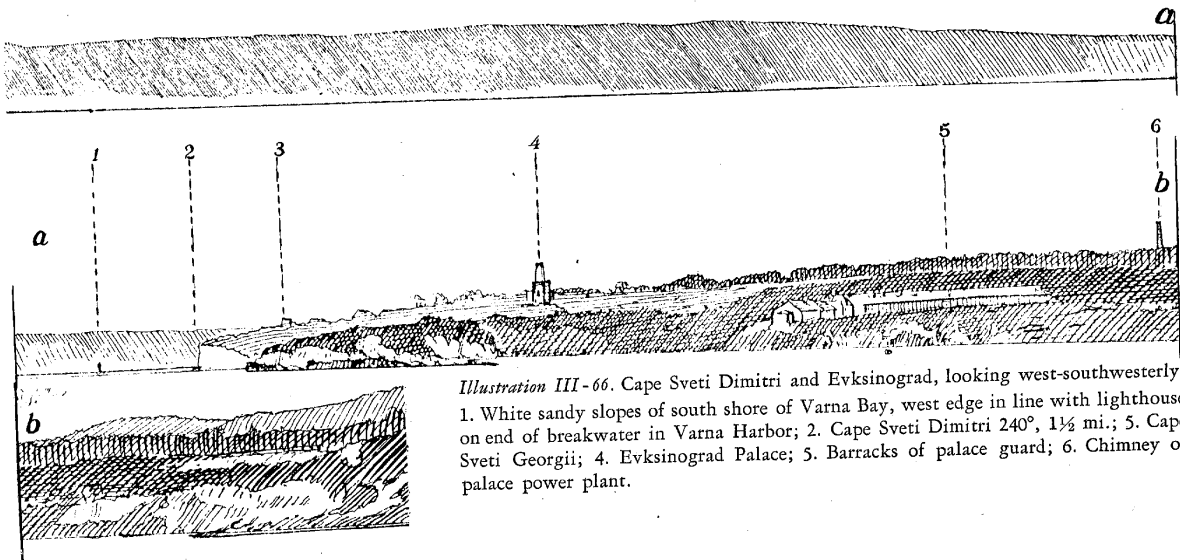




Illustration III - 67. Sveti Konstantin.
Looking northwesterly, $\frac{1}{2}$ mile north of Cape Sveti Georgii, showing sanatoria along coast.

R. Cape Sveti Georgii to Balcic.

(1) *Coastal description.* From Cape Sveti Georgii the coast trends north-northeasterly and is backed by a narrow mountain range which is at first fairly flat but then becomes undulating. As far as the broad, wooded, swampy valley of Balcic (Baljik), 12 miles from Cape Sveti Georgii, the shore is lined with steep cliffs, above which are dark slopes covered with green trees. The cliffs south of the valley are marked with two rows of broad, white limestone streaks. (Illustration III - 67.)

(2) *Dangers to navigation.*

(a) *Monastery (Chingani) Reef.* This reef, consisting of several rocky patches with depths of from 3 to 4 feet over them, extends about 1,000 yards offshore between 2 and $2\frac{1}{2}$ miles northeastward of Cape Sveti Georgii. The area for 1,000 yards

seaward of these patches is shallow, and a vessel should not approach within $1\frac{1}{2}$ miles of the coast abreast or northward of them. The summit, which lies at the western end of Mount Galata, the highest flat hill on the southern side of the Bay of Varna, situated about 1 mile west-southwestward of Cape Galata, bearing 227° true, and open a little eastward of Cape Sveti Georgii, leads eastward of this reef.

(b) *Coast from Monastery Reef to Balcic.* The coast from the northern end of Monastery Reef northward to Balcic is fringed by a bank, with depths of less than 5 fathoms and, in places, of from only 1 to 2 fathoms, which extends from 1,000 to 2,000 yards offshore. The outer edge of this bank is marked by two conical buoys, about $1\frac{1}{4}$ miles apart, the southernmost of which lies about $3\frac{3}{4}$ miles northeastward of Cape Sveti Georgii.

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34. Landing Places

A. Introduction.

Fourteen coastal maps have been assembled from Bulgarian, Turkish, French, German, and United States topographic and hydrographic charts (Figure III - 21). These maps have been oriented to suit the position of an observer approaching the shoreline from the sea. Landing beaches and specific sources of information used in their compilation have been indicated on each.

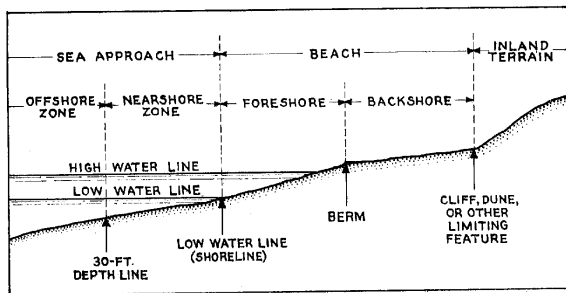
The text accompanying the maps describes only those sections of the coast which are apparently suitable for landing purposes, with no mention of the rugged, less accessible portions (Figure III - 22 and Plan III - 1).

The following tabulation indicates the factors considered and the resulting adjective rating:

Excellent	—Aerial coverage available; good literature of recent date; good maps; no factual conflicts; little or no interpretation needed.
Good	—Aerial coverage optional; good literature of recent date; good maps; no factual conflicts; some interpretation involved.
Fair	—No aerial coverage; fair to good literature often not of recent date; fair to good maps; considerable interpretation required.
Poor	—No aerial coverage; literature poor or old; maps indifferent; much interpretation required.

Shore features included in beach reports. The arrangement of the text follows the scheme shown in the accompanying diagram. The sea approach is first considered, subdivided into offshore and nearshore zones. This is followed by a description of the beach itself, and the reports conclude with a brief consideration of the inland terrain. As Figure III - 19 shows, the offshore zone includes depths greater than 30 feet below datum, and the nearshore zone extends from this depth to the low water line. The beach as a whole extends from the low

FIGURE III - 19

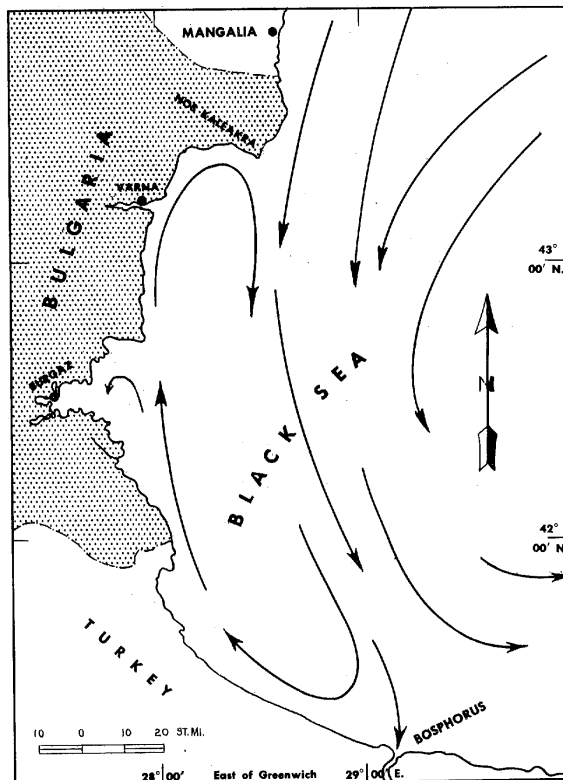


Landing Place Terminology.

water line to the cliff, dune, or other limiting feature on its inland side. The foreshore part of the beach extends from low water to the crest of the berm, which is approximately the limit of uprush of waves at high tide; the berm is recognized by the abrupt change in slope at its crest. (Narrow beaches at the foot of cliffs may not have berms.) The backshore part of the beach includes the berm to the inland limit. Usually the foreshore is firmer than the backshore, due in part to its greater moisture content. For descriptive purposes, the following classification of foreshore slopes is followed here:

Steep slopes Greater than 1 on 15
Moderate slopes Between 1 on 15 and 1 on 30
Gentle slopes Less than 1 on 30

FIGURE III - 20



BULGARIA. Direction of prevailing offshore currents.

B. Description of the coast and landing beaches.

Landing places are indicated on the accompanying coastal maps and Plan III - 1 by the following subtopic numbers:

(1) Akhtopol. (Figure III - 23.) Reliability fair.

(a) *Location and extent.* A small beach is reported in the cove just south of the town of Akhtopol at latitude $42^{\circ} 06' 50''$ N., longitude $27^{\circ} 55' 10''$ E. Very little information is available regarding its characteristics. The town of Akhtopol forms a good landmark for the entrance to the cove; it is about 52 feet above the water, on the northernmost of the two headlands of the cove entrance, and is recognizable from a distance by the windmills in its neighborhood. A light is shown from a stone tower.

(b) *Nearshore.* The entrance to the cove, a little more than 100 feet wide, is between a reef of rocks which borders the northern point and the southern point, which is bold to approach. Most of the rocks are visible and appear as large as buoys above the water. The greatest depth in the channel is about $4\frac{3}{4}$ fathoms. Depths of 24 feet are available for anchorage in the cove, but the greater part of it has depths of only about 12 feet. It is sheltered from all but easterly winds. Inside the cove wave action is negligible. There are no tides and no appreciable currents in the cove (Figure III - 20 indicates prevailing currents in the Black Sea).

(c) *Landing place.* The beach is reported composed of shingle. No accurate details are known regarding its shape and position, but it lies probably along the northeastern part of the head of the small cove, is of the order of 500 to 1,000

FIGURE III - 21

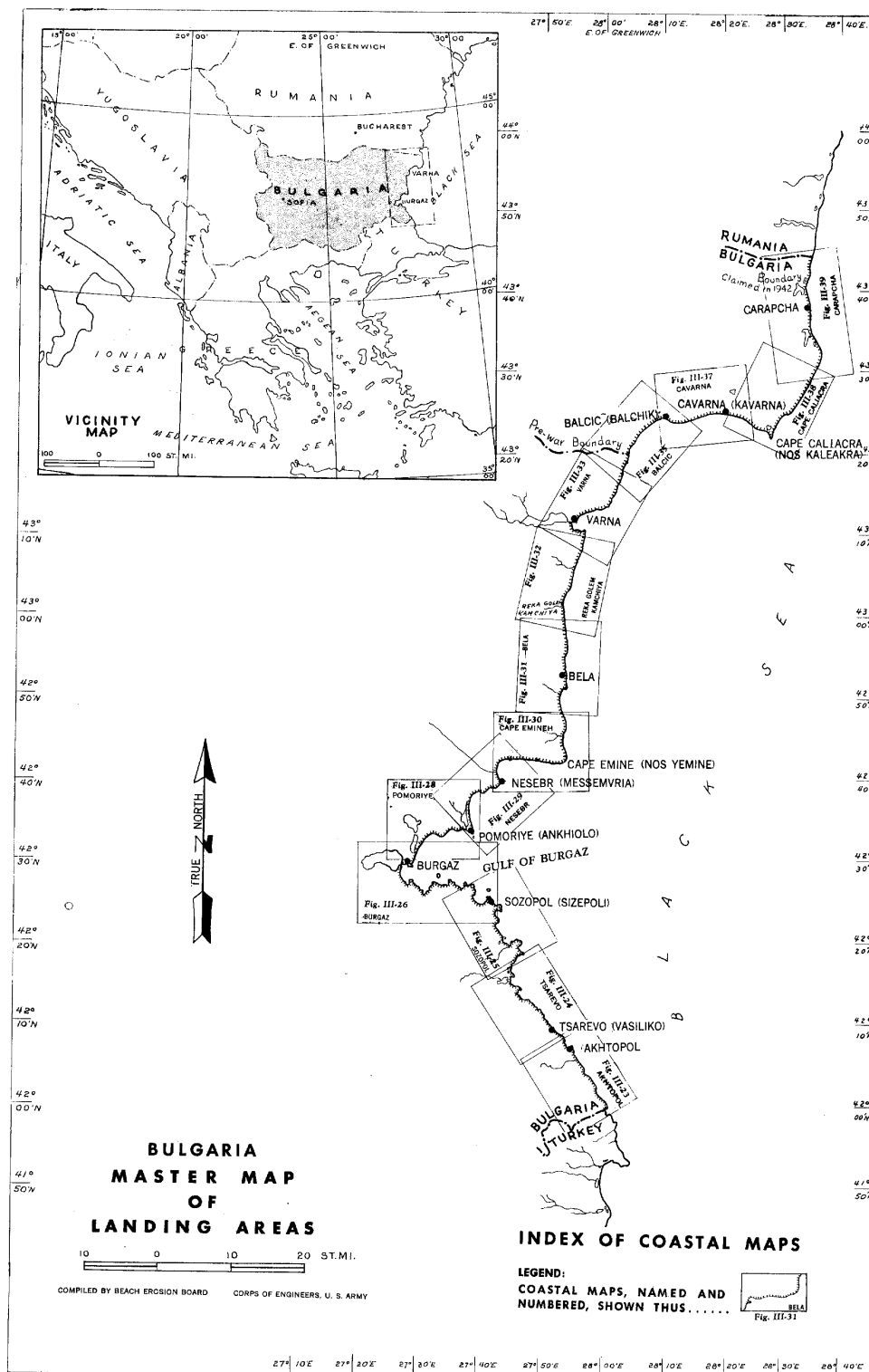
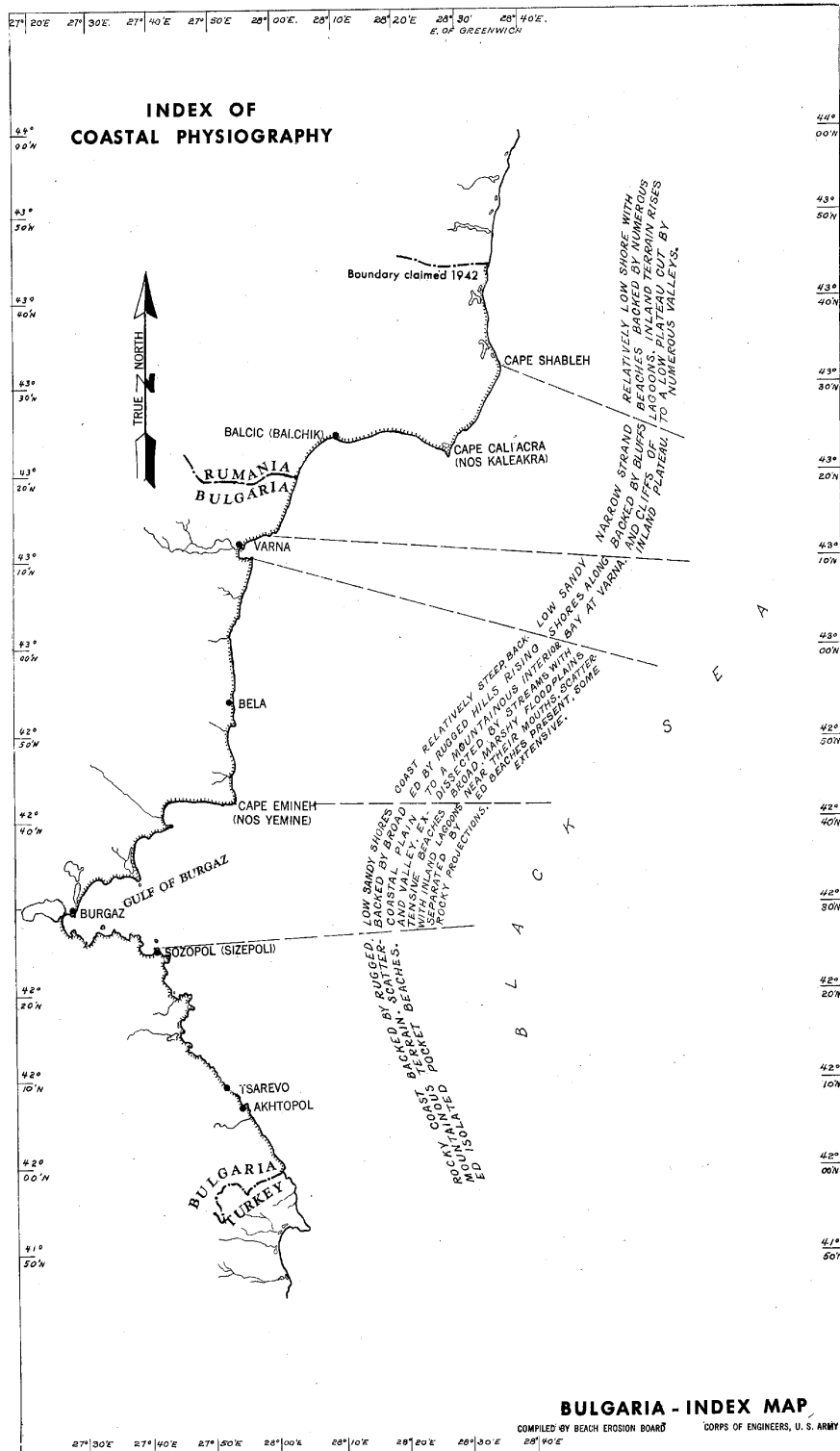
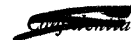


FIGURE III - 22





feet long, and very narrow, probably less than 100 feet in width. Its composition indicates a firm surface and its location suggests that it has a steep slope, both in the foreshore and backshore portions. The surf is negligible. Shore drift is inappreciable within the cove. No structures are known on the beach, but the Black Sea Coast Pilot reports for the cove: "A breakwater extending in a northerly direction affords some shelter for vessels not having a draft of more than 16 feet. There is a quay, which has a frontage of about 300 feet."

(d) *Terrain inland and on flanks of beach.* The cove is bounded by steep slopes on the south and southwest, rising rapidly to about 150 feet, then somewhat more gently to the mountains, Strandzha (Stranja) Planina. Toward the northwest the slopes are somewhat more gentle across the neck of the isthmus upon which Akhtopol is built. It is most likely that the major portion of the beach lies along the south shore of the neck. Northeastward the end of the isthmus rises in a hill crowned with the town of Akhtopol. From the south shore of the neck a road runs westward connecting with a coastal road 600 to 800 feet inland and 50 or 60 feet above the water, which runs northward and eastward to Akhtopol, and southward, within $\frac{1}{4}$ mile or so of the coast, to Turkey. From Akhtopol roads lead into the interior, and northwestward along the coast. Vegetation in the area is probably light and open.

(2) *Tsarevo (Vasiliko).* (Figure III - 24.) Reliability fair.

(a) *Location and extent.* The harbor at Tsarevo is about $\frac{1}{2}$ mile across and indented in the coast about $\frac{1}{2}$ mile. A landing place is reported on its northern shore, approximately at latitude $42^{\circ} 10' 10''$ N., longitude $27^{\circ} 51' 10''$ E. The town of Tsarevo is built on the south shore of the bay. A light is shown from a stone tower in the town, and another at the head of the breakwater.

(b) *Nearshore.* The entrance to the harbor is about 600 yards wide, between a reef which extends off the northern point, and the southern point, on which stands the village. A depth of 36 feet of water can be found in the entrance. The bottom of the harbor is sand and good holding ground west of the town, but in other parts of the harbor are sand and flat stones, over which the anchors are liable to drag. Winds are prevailing north and northeast in summer, and variable in winter. Waves are generally from the northeast, but probably neither waves nor currents are very strong in the port, especially in view of a reported breakwater mentioned in paragraph "c" below. There are no tides.

(c) *Landing place.* According to the Coast Pilot, "The best place for landing is on the northern side of the bay, where the inhabitants haul up their boats." The beach here is probably not more than $\frac{1}{2}$ to $\frac{3}{4}$ mile long, at least in its wider portion along the west and northwest portion of the bay, and very narrow. It is composed of relatively coarse material, sand and pebbles, or gravel, and is firm, with a steep foreshore slope and moderate backshore slope. The surf is light, and waves break some distance from the shore. The harbor is reported to be protected by a breakwater extending southeast and southward from the north shore.

(d) *Terrain inland and on flanks of beach.* The terrain back of the shore rises moderately steeply to the Strandzha Planina. These are heavily forested with oak and beech, but near the shore have been cut over for many years and are largely

replaced by olive groves and vineyards, particularly near the town. A road runs within about 700 feet of the northwest corner of the bay. The nearest town is the small town of Tsarevo about $\frac{1}{2}$ mile southeast. Roads run from it southward along the coast, and inland to the interior.

(3) *Nos Yemberler—A.* (Figure III - 24.) Reliability fair.

(a) *Location and extent.* A small pocket beach is indicated on the accompanying map at the mouth of a small stream just south of Nos (cape) Yemberler, at about latitude $42^{\circ} 12' 45''$ N., longitude $27^{\circ} 48' 10''$ E.

(b) *Nearshore.* Apparently the approach to the beach is clear of rock hazards; the bottom slope is steep in this region. The small headlands at the ends of the beach probably offer little if any protection from prevailing north and northeast winds and waves, or storms from the southeast. Offshore currents are generally northward. There are no tides.

(c) *Landing place.* The beach is about 1,000 feet long, and extends upstream about the same distance. It is probably composed of sand and pebbles or gravel. The foreshore is firm and has a steep slope; the backshore is somewhat softer with a moderate slope. The stream crossing the beach is very small. The belt of surf fronting it is narrow and waves break near the shore. No structures are known.

(d) *Terrain inland and on flanks of beach.* The beach lies at the mouth of a stream valley which quickly narrows to a ravine upstream. A road parallel to the coast runs close across the head of the beach, and a second road parallel to this lies a few hundred feet farther inland. From this second road, roads to the interior branch off at frequent intervals. Apparently the inland road is generally at a considerably higher elevation than the one nearest the coast, but the two roads connect within $\frac{1}{4}$ mile northwest of the beach and $1\frac{1}{4}$ miles southeast of it.

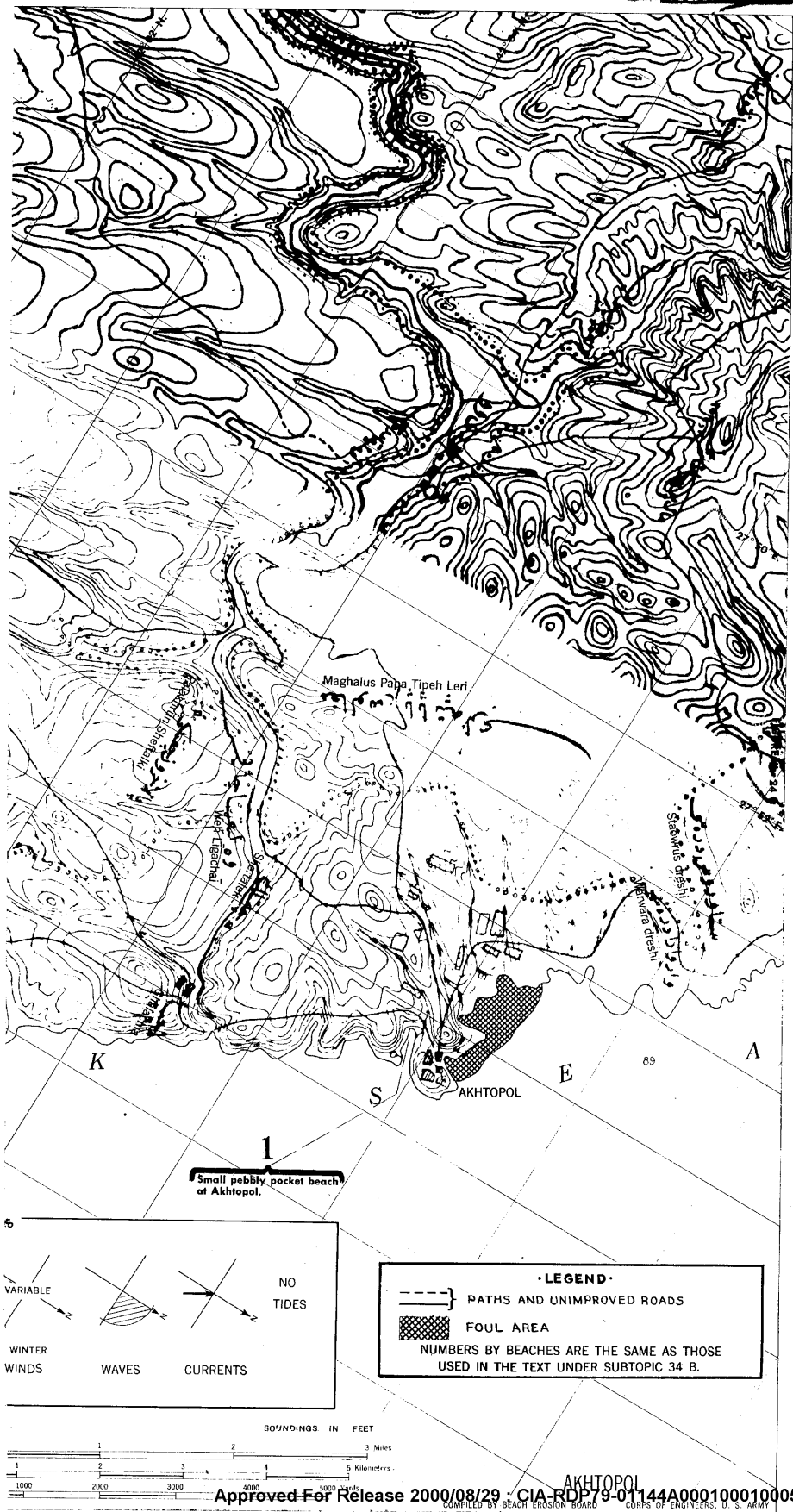
(4) *Nos Yemberler—B.* (Figure III - 24.) Reliability fair.

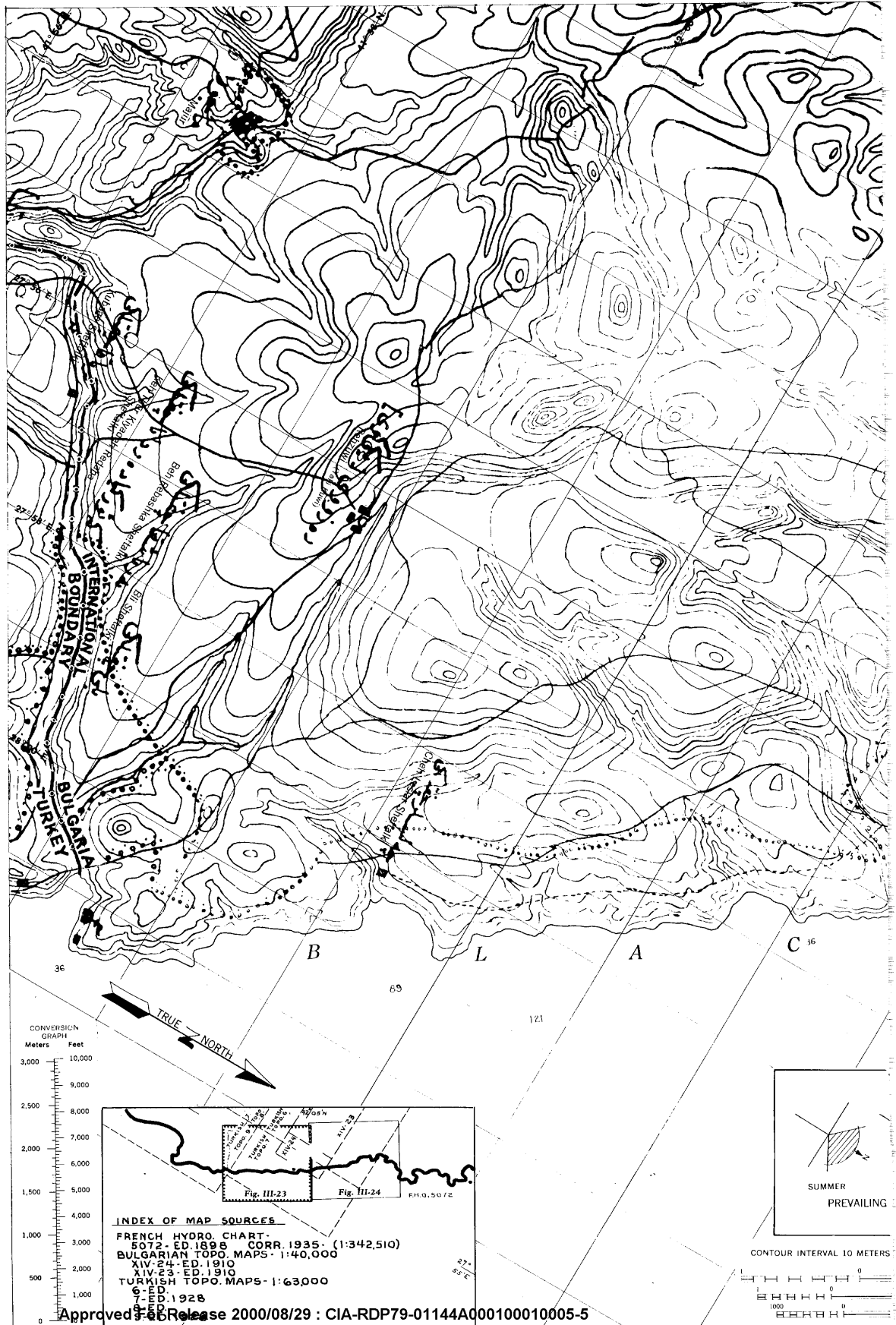
(a) *Location and extent.* A small pocket beach is indicated on the accompanying map close north of Nos Yemberler, at latitude $42^{\circ} 12' 50''$ N., and longitude $27^{\circ} 47' 50''$ E. It lies at the mouth of a small stream which passes at the foot of the town of Yemberler, located about $\frac{1}{4}$ mile from the shore.

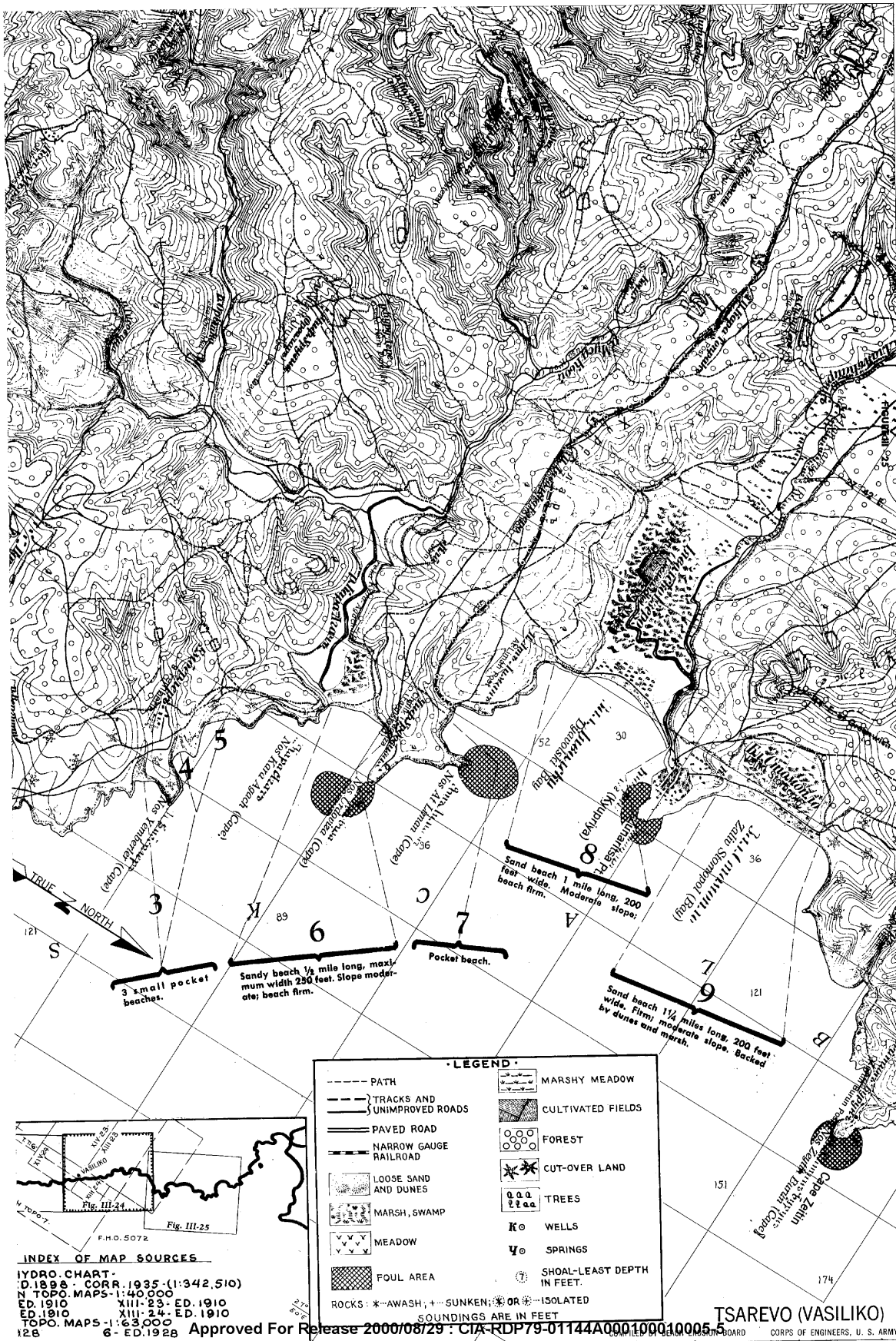
(b) *Nearshore.* The approach to the beach is apparently clear of rocks or other navigational hazards. While the beach is directly exposed to prevailing north and northeast winds and waves, the Nos (cape) Yemberler offers good protection from the more severe southeasterly storms. Currents in this region are generally to the north, but are probably not pronounced in the little cove in which the beach is located. There are no tides.

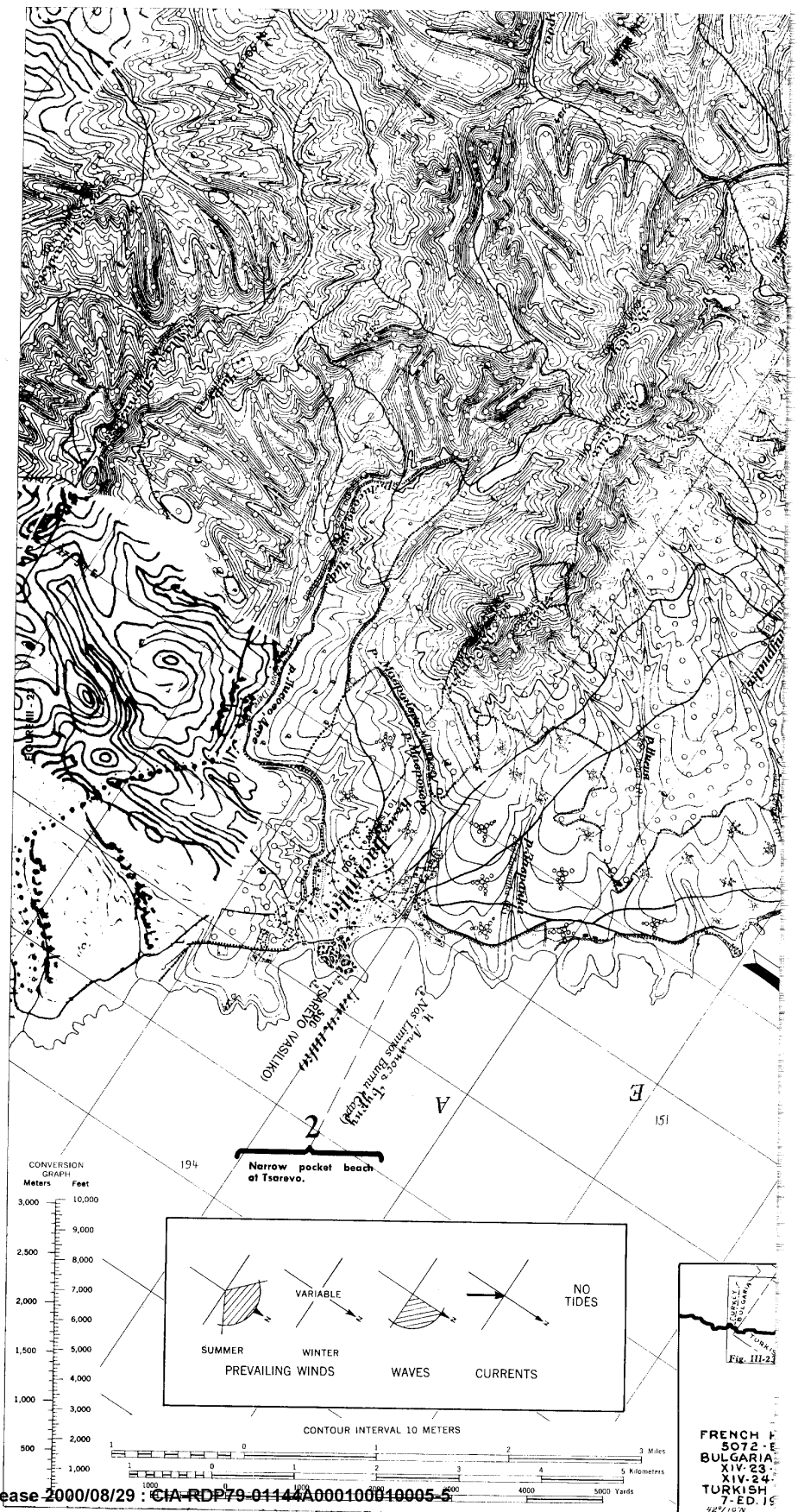
(c) *Landing place.* The beach is not more than 500 feet long and extends perhaps a slightly greater distance upstream. It is composed of sand and gravel, with some pebbles. The foreshore slope is steep, the backshore moderate and somewhat softer than the foreshore. The belt of surf is narrow and waves break close to the shore. The stream crossing the beach is very small. No structures are known on the beach.

(d) *Terrain inland and on flanks of beach.* The valley of the small stream narrows rapidly to a ravine. The town of Yemberler lies about 70 feet above the stream. Inland of Yemberler the vegetation is dense forest, but between the town and the shore is apparently cut-over land, covered with light forest and brush. A road passes close back of the head









of the beach. It branches inland to Yemberler, but otherwise follows the coast to the southeast. Northwestward it apparently degenerates to a track or trail.

(5) *Nos Yemberler*—C. (Figure III - 24.) Reliability fair.

(a) *Location and extent.* West of Nos (cape) Yemberler about $\frac{3}{4}$ mile is a small, isolated beach at the back of a broad cove. Its center is located at about latitude $42^{\circ} 13' 00''$ N., longitude $27^{\circ} 47' 20''$ E.

(b) *Nearshore.* There are apparently no rock hazards in the approach to the beach, and the sea bottom slopes fairly steeply to the shore. The prevailing north and northeast winds and waves strike it directly, and its position in the lee of Nos Yemberler offers little protection from southeasterly storms. The general northward current is probably little felt here. There are no tides.

(c) *Landing place.* The beach is about $\frac{1}{4}$ mile long and not more than 300 feet wide. Its composition is probably sand and pebbles, or gravel, with a moderate to steep surface slope, the foreshore being steeper than the backshore. Since no streams cross it, and it is entirely exposed to wave action, it is unquestionably firm. The belt of surf is narrow and waves break close to the beach. No structures are known.

(d) *Terrain inland and on flanks of beach.* The land back of the beach slopes upward moderately to an elevation of about 200 feet at a point some $\frac{3}{4}$ mile inland, where the slope becomes much more gentle. Several tracks and trails lie close back of the beach, one of which leads southeastward to a road by which southeasterly parts of the coast and inland areas may be reached, including the nearest town, Yemberler, about $\frac{1}{2}$ mile distant. Vegetation is light forest and brush of cut-over land, changing inland to heavy uncut woods.

(6) *Nos Urdoviza.* (Figure III - 24.) Reliability fair.

(a) *Location and extent.* A cove about $\frac{1}{2}$ mile across lies south of the long, narrow point of Nos Urdoviza, at the head of which is a beach whose center lies at about latitude $42^{\circ} 13' 50''$ N., longitude $27^{\circ} 46' 30''$ E. Nos Urdoviza is easily distinguishable from the other points in its neighborhood because it is white and steep, and crowned with trees.

(b) *Nearshore.* The entrance to the cove is southward of a long and wide reef which extends from the northern point for $\frac{3}{4}$ mile to the south. There are depths of 12 to 14 fathoms between the extremity of the reef and the southern point of the cove, Nos Kara Agatch. A vessel should keep close to the shore and enter the cove from the south. Anchorage is in the northern part of the cove in about four fathoms abreast of a river, the Reka Kara Agatch, and is well sheltered. Nos Urdoviza offers good protection from prevailing north and northeast winds and waves. The cove is open to southeast storms, but the reef must offer considerable protection to the shore and anchorage from heavy waves. The north-going current is probably little felt in the cove. There are no tides.

(c) *Landing place.* The beach is a little more than $\frac{1}{2}$ mile long, with a maximum width of about 250 feet. It is composed of sand, or sand and pebbles, and is somewhat soft, especially near the mouth of the river crossing it at the southern end. The foreshore slope is moderate and the backshore slope is gentle to moderate, steepening toward the north. The surf is light; heavy waves break on the protecting reef. No structures are known on the beach.

(d) *Terrain inland and on flanks of beach.* The southernmost three quarters of the beach borders the flood plain of the

Reka (stream) Kara Agatch, which is marshy for about $\frac{1}{2}$ mile inland. The northern part is backed by gentle to moderate slopes. Vegetation is swamp grasses and brush on the lowland, heavy forest on the slopes. A track or trail runs close back of the beach, and provides the only means of communication of this isolated cove with the interior, or with other coastal areas, except for a road running out to the point, Nos Urdoviza, a short distance beyond the north end of the beach.

(7) *Nos At. Liman.* (Figure III - 24.) Reliability fair.

(a) *Location and extent.* West of the Nos (cape) At. Liman is a small bight less than $\frac{1}{2}$ mile wide and indented about $\frac{1}{4}$ mile, with a beach at its head, at about latitude $42^{\circ} 14' 20''$ N., longitude $27^{\circ} 46' 05''$ E.

(b) *Nearshore.* A reef extends more than 300 yards northward of Nos At. Liman, with a few of the rocks above water. Entrance to the bight is gained from the north. The bottom slope is steep in this region, so that the shore can be approached closely. There is room here for five or six vessels in about four fathoms if they secure their sterns to the shore. A small stream, about 130 feet wide at its mouth, enters the northwest corner of the bight, and is wide enough to hold three or four vessels drawing 16 feet of water. The bight is well sheltered from the elements, from southeast through east and northeast, by Nos At. Liman and the reefs extending northward from it, and at least partially from north winds by Zunaritsa (Kyupriya) Pt. and Cape Zeitin to the northward. Southeast is the direction of storms, and north and northeast the direction of prevailing winds. Waves strike the beach from the north, but wave action inside the cove is very slight. Sustained longshore currents are not felt within the cove. There are no tides.

(c) *Landing place.* The beach at the head of the cove is about 1,500 feet long, 200 feet maximum width. Its composition is sand and pebbles, or gravel. Its surface may be somewhat soft, at least in the backshore portion; its slope is gentle to moderate. The stream crossing it at its west end is very small, but evidently has a broad lagoon at its mouth. The surf on the beach is light, and the waves break close to the shore. No structures are known.

(d) *Terrain inland and on flanks of beach.* The terrain rises steadily back of the beach with a moderate slope. The little stream which crosses the west end of the beach is not more than $\frac{1}{2}$ to $\frac{3}{4}$ mile long, and lies in a gently sloping valley. A road leads from the west end of the beach inland, branching within a short distance of the beach into a trail running northward along the coast. Another trail or track leaves the beach from about the center and runs inland. The convergence of roads at this beach suggests that it is much used as a landing place by the natives. The area is thickly wooded.

(8) *Dyavolski Bay (Zaliv Dyavolski).* (Figure III - 24.) Reliability fair.

(a) *Location and extent.* Dyavolski Bay opens between Nos At. Liman on the south and Zunaritsa Point, $1\frac{1}{2}$ miles apart. The bay is indented about a mile. The northern part of it, at its head, is bordered by a beach extending from latitude $42^{\circ} 14' 50''$ N., longitude $27^{\circ} 45' 05''$ E. to latitude $42^{\circ} 15' 50''$ N., longitude $27^{\circ} 45' 10''$ E., facing due eastward. The town of Primorsko (Kyupriya) forms a landmark. It is fronted by windmills on Zunaritsa Point.

(b) *Nearshore.* Reefs extend off both Nos At. Liman and Zunaritsa Point. There are also reefs in the bay, off the

northern shore. Otherwise the bottom slope is steep, and depths of four fathoms are found in the northern part of the bay in which a vessel may anchor with its stern secured to the shore. The 30-foot depth is close to the shore, and a depth of 52 feet is recorded in the southern part of the bay. Zunaritsa Point protects the northern part of the bay from the north and northeast winds prevailing in summer, but southeast winds sometimes cause a considerable swell. The general northward drift of the offshore currents is not appreciably felt in the bay. There are no tides.

(c) *Landing place.* The beach along the west shore of the northern part of the bay is more than a mile long in a north-south direction, and 200 to 250 feet wide. It is composed most likely of sand or sand and pebbles, and has a moderate foreshore slope, becoming gentle on the backshore. It is generally firm with its softest portion to the north near the mouth of a large stream which empties into the sea at the extreme north end of the beach. No structures are known. The surf is light, and the waves break close to the shore.

(d) *Terrain inland and on flanks of beach.* The beach is apparently backed by a narrow belt of low dunes. It borders the broad flood plain at the mouth of the river, Reka Alan-Kairyak. Near the mouth of the river this plain is nearly one mile across, and for $1\frac{1}{2}$ miles inland it is marshy, with a lake about one mile inland. The valley slopes north and south of the flood plain are moderate. Between the marsh and the beach is a narrow cultivated tract of land. Between the cultivated track and the dune belt is a road running the full length of the beach, northward to the town of Primorsko on Zunaritsa Point. Southward the road degenerates into a track or trail leading within a mile to a road running to the interior.

(9) *Stomoplo Bay (Zaliv Stomopol).* (Figure III - 24.) Reliability fair.

(a) *Location and extent.* Stomoplo Bay lies northward of Zunaritsa Point, upon which is the town of Primorsko. It is about $1\frac{1}{2}$ miles broad, from north to south, and is indented about $\frac{1}{2}$ mile. At its head is a beach extending from latitude $42^{\circ} 16' 20''$ N., longitude $27^{\circ} 45' 20''$ E., to latitude $42^{\circ} 17' 10''$ N., longitude $27^{\circ} 45' 10''$ E. The town of Primorsko forms a landmark; it is fronted by windmills on Zunaritsa Point.

(b) *Nearshore.* The bottom slope in the bay is very steep, with the 30-foot depth close to the shore. Rocks or reefs are known to be present only close to Zunaritsa Point. The bay is open to northeast winds, which with the north prevail in summer, and to southeast storms. Wave action, however, is rarely heavy. The general northerly offshore current is not noticeable within the bay. There are no tides.

(c) *Landing place.* The beach is nearly $1\frac{1}{4}$ miles long, with a maximum of about 200 feet width. It is composed of sand or sand and pebbles, has a gentle to moderate slope, steepest in the foreshore portion, and a firm surface. Apparently no streams cross it; and no structures are known upon it.

(d) *Terrain inland and on flanks of beach.* The beach is backed by a narrow belt of low sand dunes, which is in turn backed by a low coastal plain more than $\frac{1}{2}$ mile wide and extending the full length of the beach. Gentle to moderate slopes rise inland from the plain, heavily forested inland, but with a cut-over second growth to the north. The plain is covered with meadow and marsh plants; the inland slopes are wooded. A road runs inland of the dune belt southward to Primorsko, northward this road degenerates to a track or trail.

(10) *Yezero Arkutino.* (Figure III - 25.) Reliability fair.

(a) *Location and extent.* Between Nos Skopolitro and Nos Sveti Toma is a bight $1\frac{1}{2}$ miles across, indented slightly less than one mile. About 2,000 feet from the west of this area is a small lake, Yezero Arkutino. Fronting this lake (yezero) and extending along the back of the bay is a beach about $1\frac{1}{2}$ miles long, between latitude $42^{\circ} 19' 55''$ N., longitude $27^{\circ} 45' 15''$ E., and latitude $42^{\circ} 20' 20''$ N., longitude $27^{\circ} 43' 40''$ E.

(b) *Nearshore.* The bottom slope in this area is very steep. In entering the cove it is necessary to keep to the northwest to avoid extensive reefs east and north of Nos Skopolitro. The cove opens to the northeast, and is thus exposed to north and northeast prevailing winds and waves, but is protected from southeast storms by the peninsula terminating in Baghlar Point (Nos Kuratan). The offshore current in general flows northward, but in this bight currents are weak and variable. There are no tides.

(c) *Landing place.* The beach is continuous for its entire length of about $1\frac{1}{2}$ miles, and its northern part is more than 200 feet wide; it narrows to the southeast, and may locally be less than 100 feet wide. The beach is generally crescentic in shape, but has a short projection a little south of the center. The slope of the foreshore is moderately steep along this entire beach, whereas the slope of the backshore is relatively gentle and may be nearly horizontal in the northern half of the beach. The foreshore is relatively narrow and firm, but the backshore may be somewhat soft. The beach is composed of sand and may locally have pebbles or gravel. The surf along this beach occurs in a narrow belt; the waves break close to the shore. Shore drift, while not prominent, is generally from both sides of the beach toward the center. No structures are known along this beach.

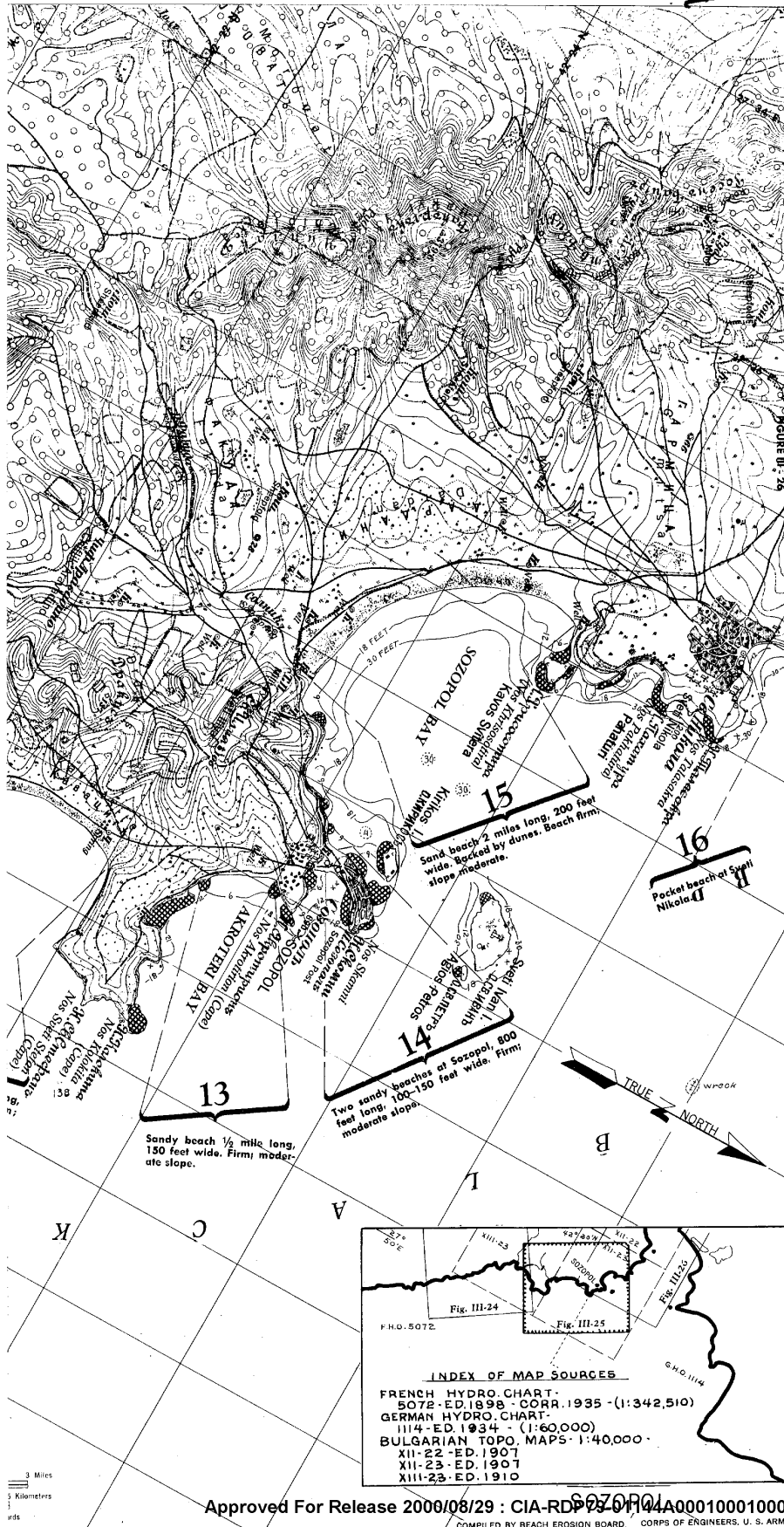
(d) *Terrain inland and on flanks of beach.* The northern part of the beach is backed by a belt of dunes which locally extends about $\frac{1}{2}$ mile inland. Beyond the dune belt, near its western edge, is the small lake, Yezero Arkutino, with no visible outlet across the beach. The southern half of the beach is backed by higher ground, and a short distance inland is the Reka (stream) Kargan (Ropotamo), which flows nearly parallel to the beach near its mouth, and has its outlet at the extreme eastern end of the beach. A small coastal plain with a maximum width of nearly a mile lies behind the beach. Yezero Arkutino lies on the western part of the plain, and along its eastern part, near the river, the ground is marshy. A hill about 40 meters high interrupts the plain in the middle, and overlooks the beach on both sides. The beach is also dominated by the high land of Nos Skopolitro and Nos Sveti Toma at either end, and by the steep slopes rising behind the plain. Exit from the beach is afforded by a road leading northwestward along the coast to the town of Sozopol, seven miles distant. This road runs along the back of the beach, degenerating southward to a track or trail. It is joined at the north end of the beach by roads leading inland. The flat lands appear to be locally cultivated, but the slopes are uniformly forest clad.

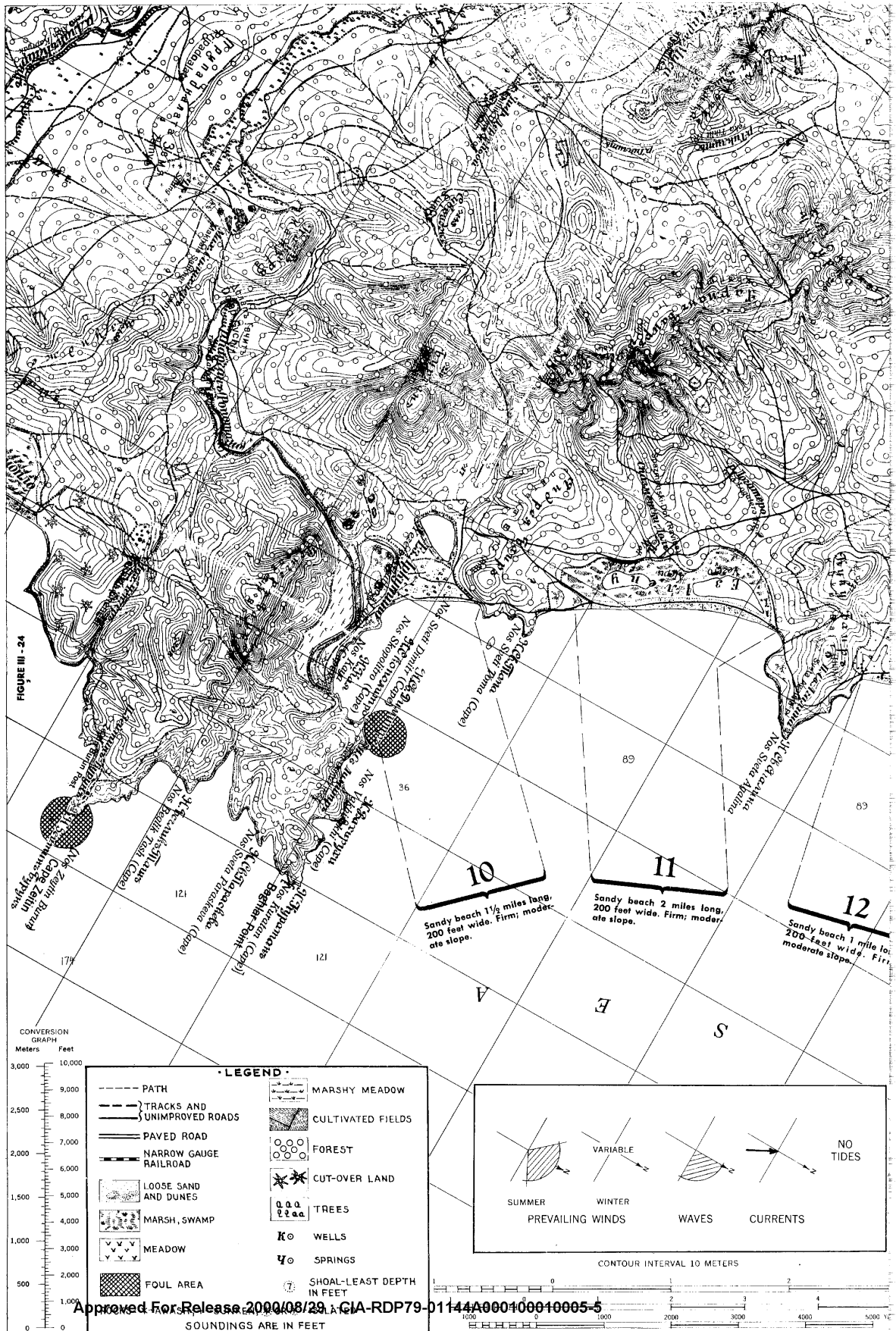
(11) *Yezero Alepu.* (Figure III - 25.) Reliability fair.

(a) *Location and extent.* Between Nos Sveti Toma and Nos Sveta Agalina lies a sand beach nearly two miles long and 200 feet wide. Its southeast end is at about latitude $42^{\circ} 20' 55''$ N., longitude $27^{\circ} 43' 15''$ E.; its northwest end at latitude $42^{\circ} 22' 20''$ N., longitude $27^{\circ} 42' 30''$ E. Close back of it are two small lakes referred to together as Yezero Alepu.

FIGURE III-25

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(b) *Nearshore.* The bottom slope is very steep. No reefs or other hazards are known in the vicinity of the beach. This bight faces east-northeast and so although it is somewhat protected from the north, is exposed to the northeast. It is sheltered in part from the prevailing north and northeasterly winds and waves. The promontory terminating in Baghlar Point (Nos Kuratan) affords shelter from the southeasterly storm winds, but offers only slight shelter from southeasterly storm waves. The offshore current in this vicinity flows generally northward, but its effect is probably not felt along this beach, where the currents are weak and variable. There is no tide.

(c) *Landing place.* The beach, which is nearly two miles long and 200 to 250 feet wide, faces the northeast. It is nearly straight and is uninterrupted along its entire extent. The beach is composed of sand, possibly sand and pebbles. The foreshore is relatively narrow, firm and has a moderate to steep slope; the backshore is soft and has a much gentler slope. The surf along this beach occurs in a narrow belt; the waves break close to the shore. The shore drift is not marked, but generally occurs from north to south. Structures are absent along the beach.

(d) *Terrain inland and on flanks of beach.* The beach is limited on its inward edge by a narrow belt of wind-blown sand. Behind this sandy belt stretches a limited coastal plain about ½ mile wide, partly occupied by the two lakes, Yezero Alepu. The lakes are surrounded by low ground which is apparently marshy, at least during rainy seasons. The beach is dominated by relatively high ground at Nos Sveti Toma and Nos Sveti Agalina, as well as by the moderate slopes leading inland behind the narrow coastal plain. Marsh grasses and low brush of the plain give way to thick forests on the slopes. Exit from the beach is afforded by a road which runs along it connecting on the southeast with a trail leading southward. Northward the road leads to Sozopol about four miles distant.

(12) *Beach between Nos Sveta Agalina and Nos Sveti Stefan.* (Figure III - 25.) Reliability fair.

(a) *Location and extent.* Between the capes, Nos Sveta Agalina and Nos Sveti Stefan, is a sandy beach slightly more than one mile long and about 200 feet wide. Its southern end is located at latitude 42° 23' 00" N., longitude 27° 42' 30" E., its northern end at latitude 42° 24' 00" N., longitude 27° 42' 30" E.

(b) *Nearshore.* The bottom slope up to this beach is very steep. No hazards are known which obstruct the approach to the shore. Good summer anchorage is afforded off this bay in depths of 18 to 20 fathoms, mud bottom. The beach lies along the inner shore of a small bight which faces the east. It is protected from the north and northeast by a promontory terminating in Nos Sveti Stefan, and is open to the south and southeast. Thus the beach is sheltered from the prevailing winds and waves from the north and northeast quadrant, but is exposed to storms from the southeast. Currents offshore from this locality flow generally northward, but within the bight they are weak and variable. There is no tide.

(c) *Landing place.* The beach at the head of the bight is slightly more than one mile long and averages about 200 feet wide. It runs uninterruptedly between the headlands. It is composed of sand, probably mixed with some pebbles. The foreshore is relatively narrow, firm and has a moderate to steep slope. The backshore is somewhat softer and has a much

gentler slope. The surf along this beach occurs in a narrow belt; the waves break close to the shore. The intensity of the surf diminishes to the north under normal conditions. Shore drift is not marked, and may occur either to the northward or southward. Structures are absent along the beach. In the northwestern angle of this bay, indicated by a small circle on the map, are several copious springs of clear, wholesome water, which rise from a loose bed of sand about 400 yards from the shore. The spot is well indicated by circular clumps of trees at the springs.

(d) *Terrain inland and on flanks of beach.* The beach is backed by a narrow belt of wind-blown sand, widening locally at its northern end. Inland of the sand belt is a limited plain which rises in gentle to moderate slopes to hilly terrain. The beach is dominated both by these slopes and by the high land along the two rocky promontories at either end. The lower slopes of the hills are cultivated. Exit from the beach is afforded by a road paralleling the shore along the inner edge of the beach. This road leads to Sozopol about 1½ miles distant from the northern end of the beach. It joins other roads leading inland.

(13) *Akroteri Bay (Zaliv Akrotirion).* (Figure III-25.) Reliability fair.

(a) *Location and extent.* The inner shore of Akroteri Bay is occupied by a sandy beach about ½ mile long and approximately 150 feet wide. Its center lies about at latitude 42° 24' 45" N., longitude 27° 42' 00" E. This beach lies just southeast of the southern part of the town of Sozopol, which partly occupies high land lying immediately northwest of the bay.

(b) *Nearshore.* The offshore bottom slope is moderate in this area; the 18-foot depth line lies about 1,000 feet from shore. At a distance of 3,000 feet the depth is about 60 feet. The approach to the beach is clear, but areas of reefs occur along the rocky shores on both sides. The beach is exposed to the prevailing north and northeasterly winds during the summer, but protected to some extent from the northwesterly winds of winter. The beach is also sheltered from southeast storms by the promontory terminating in the Nos (cape) Sveti Stefan. The beach receives strong wave action from the northeast, but is sheltered from the southeast. The offshore current flows northward, but within the bight the currents are weak and variable. There are no tides.

(c) *Landing place.* The beach occupies the northern part of the southwest shore of the bight and is about ½ mile long and 150 feet wide. It is essentially straight and uninterrupted. It is composed of sand, or sand mixed with pebbles. The foreshore slope is moderate and the sand is firm, whereas the backshore has a gentle slope and is softer. The surf is moderate, the waves breaking relatively near shore in more than a single line of breakers. Shore drift along the beach is variable, but is probably predominantly toward the southeast. There are no structures on the beach. A well is located a short distance inland.

(d) *Terrain inland and on flanks of beach.* The terrain behind the beach rises in moderate slopes to hilly country less than one mile inland. The beach is overlooked by these slopes as well as by high land at both ends. The slopes are apparently cultivated. Exit from the beach is afforded by a trail which runs along its inner edge and climbs a low hill northward to Sozopol. Southward it connects with other trails and roads running inland and south along the coast.



Illustration III - 68. Sozopol.

Looking northerly at beach on eastern side of the isthmus.

(14) Sozopol. (Figure III - 25.) Reliability fair.

(a) *Location and extent.* The town of Sozopol, which has a population of about 4,000, lies at the end of a sandy isthmus which projects about $\frac{3}{8}$ mile from the shore. The eastern side of the sandy isthmus is a bathing beach about 800 feet long; on the western side of the isthmus is a sandy beach of about the same length with a landing stage upon it. The latitude of Sozopol is $42^{\circ} 25' 30''$ N., its longitude $27^{\circ} 41' 40''$ E. Landmarks for the area are the buildings of the town as well as the island (Ostrov) Sveti Ivan, which has a lighthouse on a white concrete tower elevated 143 feet above the sea. The island is about $\frac{1}{2}$ mile in length from east to west and lies about $\frac{3}{8}$ mile north of the town.

(b) *Nearshore.* In addition to Sveti Ivan I. there are two other small islands off Sozopol. Agios Petros (Ostrov Sveti Petr) is the smaller islet at the eastern edge of Sveti Ivan I. Kirikos I. (Ayios Petros) is an islet about $\frac{1}{4}$ mile long lying about an equal distance northwest of Sozopol. The shores of all these islands are lined with reefs, as is the end of the isthmus on which lies Sozopol. The bottom slope off the beaches just south of town is relatively gentle, with the 18-foot depth line lying nearly 2,000 feet from the eastern beach, and an equal distance from the western beach. The 30-foot depth line on the eastern side is about 2,500 feet from shore and on the western side is slightly farther. Reefs occur at both ends of the two beaches. The beaches are both fairly well protected from winds and waves of all directions, although the eastern

beach is open to the east. Near the beaches the currents are variable. There are no tides.

(c) *Landing place.* The sandy isthmus is about 1,000 feet across and nearly the same in length. The eastern side is bordered by a bathing beach 800 feet long and 100 to 150 feet wide (Illustration III - 68), the western side by a beach of approximately the same dimensions; between the beaches are streets and a church. The beaches are composed of sand, perhaps with pebbles. The foreshore slopes are moderate, the backshores and inner portion of the isthmus is flat, the foreshore areas are firm. When waves are running the surf breaks over a relatively wide belt with several lines of breakers. The shore drift is apparently from south to north along the beaches. The western beach has a small landing stage located near its southern end.

(d) *Terrain inland and on flanks of beach.* Inland of the sandy isthmus the terrain rises in moderate slopes to hilly country. The lower slopes are cultivated, and the hills appear to be cut-over, second growth of light forest and brush. Exits from the beach are provided by the streets along the isthmus connecting the old part of town to the north with the houses south of the isthmus, and leading to roads running inland and southward, and also connecting with a road running northwestward along the coast.

(15) Sozopol Bay (Zaliv Sozopol) [Sozopol to Kavassitira (Nos Khrisosotira)]. (Figure III - 25.) Reliability fair.

(a) *Location and extent.* About $1\frac{1}{2}$ miles southwest of

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Sozopol is a beach which extends nearly to Kavos Svitera (Nos Khrososotira). This sandy beach extends for about two miles along a gentle arc from latitude 42° 24' 30" N., longitude 27° 40' 15" E. to latitude 42° 25' 50" N., longitude 27° 38' 40" E.

(b) *Nearshore.* The approach to the beach in Sozopol Bay is clear in its center portion, but shoals and reefs project outward from the shore at both sides of the bay. These can be avoided by an approach to the central portion of the bay from the north. Along the beach, the 18-foot depth lies about 1,000 feet from the shore, and the 30-foot depth line is about 2,500 feet from shore. The best and most sheltered anchorage in Sozopol Bay is in the southeastern part in six to seven fathoms of water. The bay is partly sheltered from north-easterly winds and waves by Sveti Ivan Island, but is open to the north. Currents are relatively weak and variable. There are no tides.

(c) *Landing place.* The beach at the head of the bay is sandy, and about two miles long, 200 to 250 feet wide. The foreshore is relatively narrow, has a moderate slope and is firm. The backshore has a gentle slope and becomes increasingly soft as the dune belt inland is approached. The surf when present breaks over a relatively wide belt with several lines of breakers. The surf intensity apparently diminishes in both directions from the center of the beach. Shore drift is variable. No structures are present. Several wells are located near the southeast end of the beach and one near the north-west end.

(d) *Terrain inland and on flanks of beach.* The beach is backed by a narrow coastal plain about ½ mile wide, leading inland to a series of gentle and moderate slopes culminating in hills about 1,000 feet high a few miles inland. Immediately behind the beach is a narrow belt of dunes, which may be locally as much as 500 feet wide. The inland plain and the lower slopes have pastures, fields and orchards. The higher hills are forested. At both ends the beach is dominated by relatively high ground forming a short promontory north of the beach and a spur of hills extending to the shore and limiting the beach to the southeast. On the inland side of the dune belt is a road, said to be unmetalled but passable, running northwestward to the town of Sveti Nikola 1½ miles beyond the beach, and degenerating southeastward to a trail leading to Sozopol. It connects with numerous inland roads.

(16) *Sveti Nikola.* (Figures III - 25 and III - 26.) Reliability fair.

(a) *Location and extent.* The town of Sveti Nikola is situated on the rocky promontory northwest of Sozopol Bay. This promontory has several small headlands; the principal ones are Nos Khrososotira (Kavos Svitera), Pahaturi (Nos Pakhatura), Nos Talasakra, and Nos Ativolos (Cape Akin). This last headland is easily distinguished by an isolated, round, wooded hill that rises ½ mile south of its extremity. Sveti Nikola lies in a small bight between the two latter headlands. Several beaches occur along this promontory. A short, sandy isthmus at latitude 42° 25' 55" N., longitude 27° 39' 00" E. connects Kavos Svitera with the mainland. A small pocket beach lies between Kavos Svitera and Pahaturi, in latitude 42° 26' 25" N., longitude 27° 38' 40" E. A beach fronts the town of Sveti Nikola, at latitude 42° 26' 55" N., and longitude 27° 38' 10" E. Nos Ativolos is also connected to the mainland by a sandy isthmus lying in latitude 42° 27' 25" N., and longitude 27° 37' 33" E. Two small pocket beaches are also present, one lying a short distance north of Sveti Nikola in latitude

42° 27' 20" N., longitude 27° 36' 40" E., and the second a short distance south of the isthmus at Nos Ativolos at latitude 42° 27' 05" N., longitude 27° 37' 35" E.

(b) *Nearshore.* The approach to the 30-foot depth line is clear along this promontory. The offshore bottom slope is moderately steep, with a 30-foot depth lying as close as 600 feet from some of the smaller headlands, but departing as far as 2,000 feet off some of the beaches. Most of the coast is lined with nearshore reefs and shoals, however, all the beaches are clear except the small sandy isthmus at Kavos Svitera. The promontory as a whole is exposed to winds of the north and northeast. There is no tide.

(c) *Landing place.* With the exception of the beach fronting the town of Sveti Nikola, the beaches are relatively isolated. They generally occur in small coves at the foot of steep slopes, and with no trails or roads as exits. The sand beach fronting the town is about ½ mile long and generally narrow, probably not exceeding 100 feet in width. The foreshore has a steep to moderate slope and is firm. The surf on this beach breaks over a moderately wide zone, with several lines of breakers. No information is available regarding the presence of structures on this beach.

(d) *Terrain inland and on flanks of beach.* The beach at Sveti Nikola is backed directly by the streets of the town. From the town roads radiate inland and along the coast in several directions. The town apparently rises from the shore of the bay reaching elevations of about 40 meters on its inland parts. The headlands on either side also overlook the beach. Without exception the several other beaches along the promontory are dominated by high land. Inland from the promontory the terrain rises in moderate to gentle slopes to a range of hills a few miles distant with elevations as high as 1,000 feet. The lower slopes are cultivated, and the higher hills are forested.

(17) *Beach between Nos Ativolos and Nos Atiya.* (Figure III - 26.) Reliability fair.

(a) *Location and extent.* Between Nos Ativolos (Cape Akin) and Nos Atiya is a bay about two miles across indenting the coast for about a mile. The inner shore of this bay is a narrow, sandy beach about two miles long. According to an intelligence report, it is rumored that there is a naval base in this bay. However, in the absence of definite information, the bay will be described on the assumption that the base is not there in order to bring out the physical features of the area. A suitable landmark for this bay is the eastern headland, Nos Ativolos, which can easily be distinguished by an isolated, round, wooded hill that rises ½ mile south of its extremity. The latitude of the center of the beach is 42° 26' 40" N., its longitude 27° 36' 30" E.

(b) *Nearshore.* The offshore approach to the 30-foot depth is clear along the bay. This depth lies about 1,800 feet from the shore. The 18-foot depth lies about halfway between the shore and the 30-foot depth. Scattered areas of nearshore reefs occur along the rocky sides of the bay, but as far as is known, the approach to the beach is clear. The bottom material of the bay is sand, with a moderate slope. The bay is open to the north, but partly sheltered from the northeast and east. Waves from the northeastern quadrant strike the western half of the bay directly but the eastern half lies in the shelter of Nos Ativolos. Data regarding currents in Burgaz Bay as a whole are scant, but there appears to be a general counter-clockwise current in the gulf. Thus in this area the offshore

current moves generally to the east; but close to the shore in the bight the currents are probably variable. There are no tides.

(c) *Landing place.* The beach is nearly two miles long, but relatively narrow, with a width in places of only about 100 feet. The beach is composed of sand, probably mixed with pebbles. The foreshore has a moderate slope and is firm. The backshore has a very gentle slope and is somewhat softer. The surf breaks over a wide zone with several lines of breakers, but the intensity of the surf diminishes toward the eastern part of the beach. The direction of shore drift is probably variable, with a slight predominance in a westerly direction. No structures are known along this beach, but attention is called to the previous statement regarding a rumored naval base.

(d) *Terrain inland and on flanks of beach.* A relatively narrow plain backs the beach. Inland the country rises in moderate to steep slopes to a range of hills a few miles southward, with elevations of as much as 1,000 feet. Exit from the beach is afforded by a road which runs close inland along at least the eastern half of the beach. This road connects with Sveti Nikola on the east and continues along the shore on the west. The plain and the lower hill slopes are cultivated, largely in orchards, whereas the higher hill slopes are forested.

(18) *Nos Atiya.* (Figure III - 26.) Reliability fair.

The small headland of Nos Atiya is located in latitude 42° 27' 50" N., longitude 27° 35' 00" E. This rocky headland has several small isolated pocket beaches along the shore, but none exceeds a length of about 500 feet, and all of them are backed by steep slopes rising up to a hill about 350 feet high.

(19) *Atiya Bay (Zaliv Atiya).* (Figure III - 26.) Reliability fair.

(a) *Location and extent.* Between Nos Atiya and Nos Sveta Anastasiya is a bight about two miles broad, indented about one mile inland. Opposite its western edge and lying nearly a mile offshore is Sveta Anastasiya Island. This island is small, and is characterized by a lighthouse, a convent and a mill. A small landing place is located on its southwestern side. The inner shore of the bight is a sandy beach about 1¼ miles long, which lies along the eastern half. The western end of the beach lies at latitude 42° 26' 55" N., and longitude 27° 33' 15" E.; the eastern at latitude 42° 27' 00" N., longitude 27° 34' 50" E.

(b) *Nearshore.* The approach to the beach is clear between Nos Atiya and the island to the west. The bottom slope is moderate, with the 30-foot depth lying an average distance of about 3,000 feet from the shore, although the course of the depth line is somewhat irregular. The 18-foot depth lies about 2,000 feet from the shore along most of the beach. Nearshore reefs occur along the rocky headland northeast of the beach, and along the cliffed shore northwest of the beach. The bight is open to the north, but it is partly sheltered from the northeast and east. Waves from the northeastern quadrant strike the western shore of the bight, but much of the beach itself lies in the shelter of Nos Atiya. The offshore current in the vicinity of the bight is apparently to the east; but in the bight currents are variable. There are no tides.

(c) *Landing place.* The beach is 1¼ miles long and probably not more than 100 feet wide. It is interrupted near its northeastern end by a small, rocky point. The beach is composed of sand mixed with some pebbles. The foreshore slope is moderate and the sand is firm. The surf breaks over a wide zone, with several lines of breakers. The intensity of the surf

diminishes eastward along the beach when waves approach from the northeast. Shore drift is variable, with a slight predominance to the west. There are no structures on the beach.

(d) *Terrain inland and on flanks of beach.* A narrow zone of relatively flat land lies behind the eastern part of the beach, but to the west a spur of the southern hills extends close to the shore. Nos Atiya itself has an oval hill with an elevation of about 350 feet. The terrain appears to be generally forested. Exit from the beach is afforded by a road which continues eastward to Sveti Nikola and degenerates to a trail westward. This road is also connected with inland roads.

(20) *Chingani Bay—A.* (Figure III - 26.) Reliability fair.

(a) *Location and extent.* Southwest of Nos Sveta Anastasiya is a small beach about ½ mile long in a shallow bight within Chingani (Chengene Skele) Bay, with its center at latitude 42° 26' 50" N., longitude 27° 32' 10" E.

(b) *Nearshore.* The offshore approach to this beach is clear of hazards. The bottom slope is moderate, with the 30-foot depth lying about 3,000 feet from shore. The 18-foot depth line averages about 1,600 feet from the shore. Nearshore reefs line the rocky shores on both sides of the beach. Anchorage is provided opposite the beach in depths of about 33 feet. The beach is sheltered from winds and waves from the north and northeast through east. Data are lacking on the currents near this beach, but offshore from the mouth of Chingani (Chengene Skele) Bay the current apparently moves eastward. There are no tides.

(c) *Landing place.* The beach, which is composed of sand, is about ½ mile long and 200 feet wide. The foreshore slope is moderate and the sand is firm. The backshore has a very gentle slope and is somewhat softer. Surf is generally light, but when waves are running the surf occurs over a wide belt with several lines of breakers. No structures are known on the beach.

(d) *Terrain inland and on flanks of beach.* The beach is backed by a low, marshy area and several little ponds. Inland of this marshy area, and to the south of the beach itself, the terrain rises in moderate slopes to hilly country. Northeast of the beach is a headland with a height of about 85 feet. The hill slopes to the south are forested. No trails or roads run along the beach, but a trail parallels the shore at a distance of about ½ mile inland. This trail connects with a road on the east and others to the south.

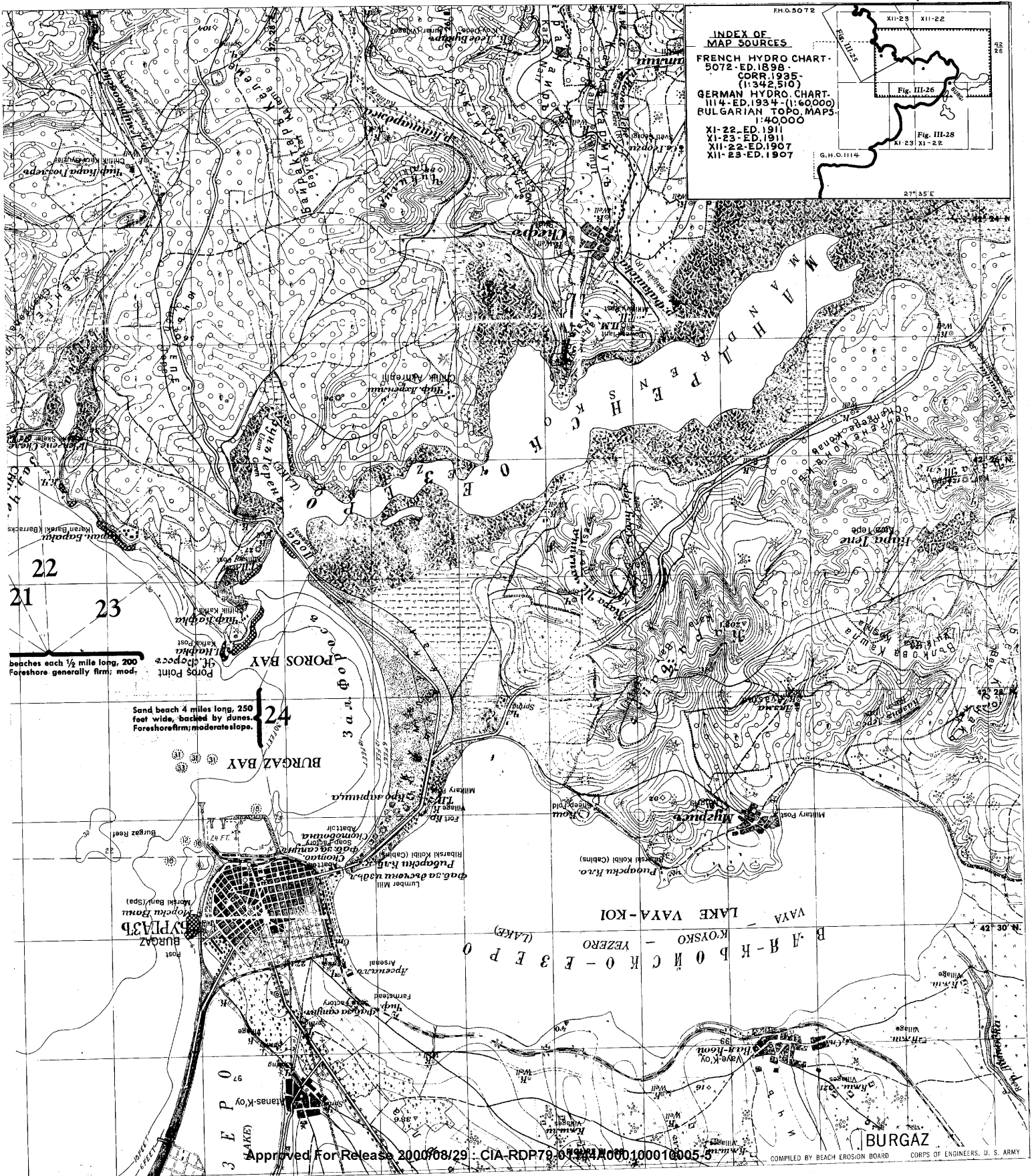
(21) *Chingani Bay—B.* (Figure III - 26.) Reliability fair.

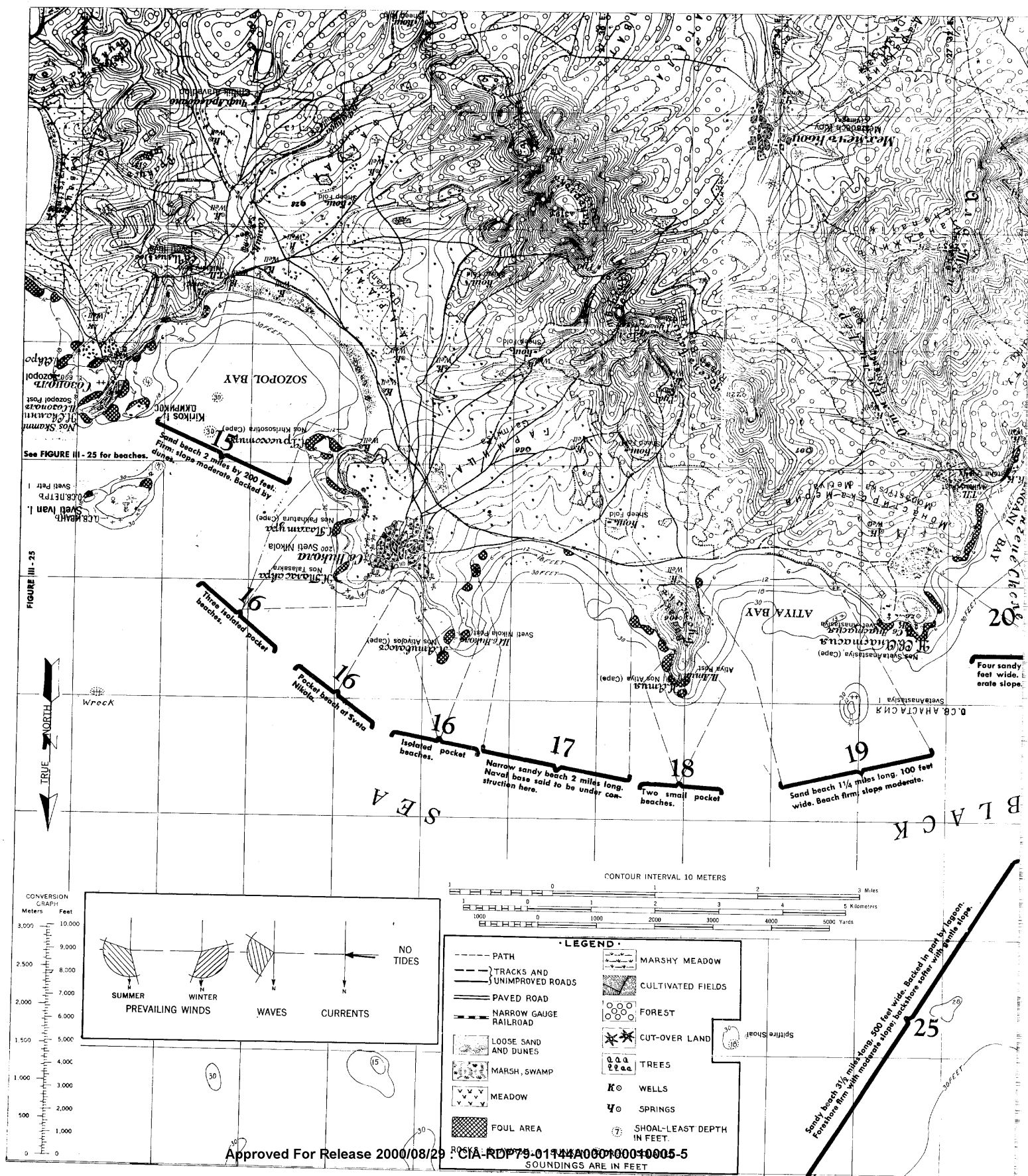
(a) *Location and extent.* About 1¼ miles southwest of Nos Sveta Anastasiya is a small beach, slightly less than ½ mile long, with its center at latitude 42° 26' 10" N., longitude 27° 31' 40" E.

(b) *Nearshore.* The offshore approach to this beach is clear of hazards. The bottom slope is gentle to moderate, with the 30-foot depth line nearly ¾ mile from shore. The 18-foot depth is about 1,600 feet from the beach. Nearshore reefs occur at both ends of the beach along the rocky coast. The beach is sheltered from winds and waves from northeast through east. Data are lacking on currents near this beach, but offshore from the mouth of Chingani Bay the current apparently moves eastward. There are no tides.

(c) *Landing place.* The beach is composed of sand. It is slightly less than ½ mile long, and may be as much as 200

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feet wide. A small stream discharges into the sea at the extreme northeastern end of the beach. The forshore slope is moderate and the sand is firm. The backshore has a more gentle slope and is somewhat softer. Surf is generally light, but when waves are running the surf occurs over a wide belt with several lines of breakers. No structures are known on the beach.

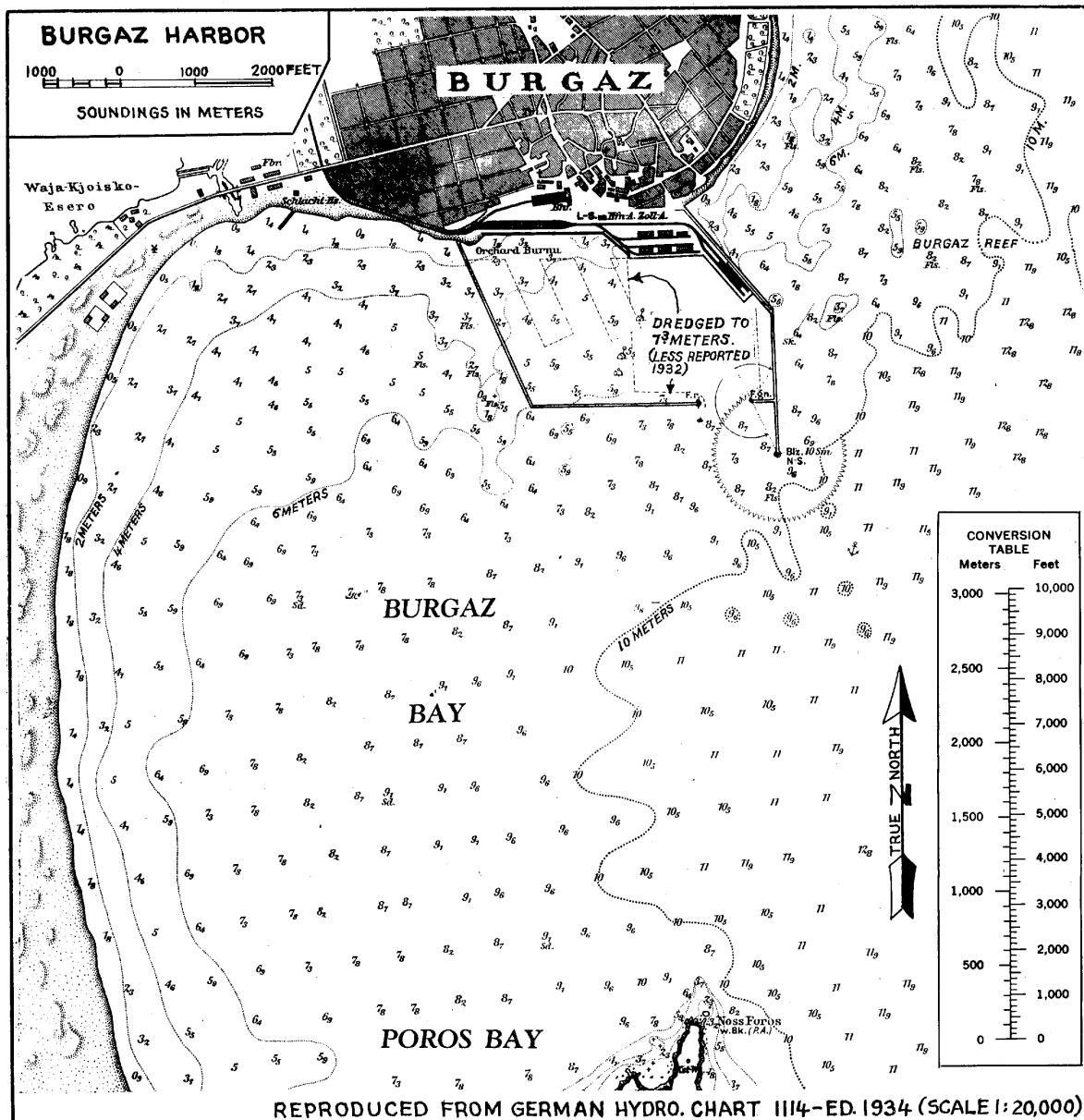
(d) *Terrain inland and on flanks of beach.* The beach is backed by a low, marshy area through which flows a sluggish stream. The marshy area is surrounded on three sides by

relatively steep slopes leading to hilly country. The hills are forested. A road from Sveti Nikola to Burgaz runs along the southern margin of the marshy area to the shore, and apparently exit may be made from the beach to this road. A branch of this road leads northeastward and joins with another running along the shore.

(22) *Chingani Bay—C.* (Figure III - 26.) Reliability fair.

(a) *Location and extent.* At the head of Chingani Bay is a small, sandy beach about $\frac{1}{2}$ mile long, with its center at latitude $42^{\circ} 25' 40''$ N., longitude $27^{\circ} 30' 45''$ E.

FIGURE III - 27



BULGARIA. Port plan of Burgaz showing approach to Poros (Foros) Bay beach.

(b) *Nearshore.* The approach to the beach is clear of hazards. The bottom slope is fairly gentle. The 30-foot depth line lies about one mile from shore. The 18-foot depth line is about $\frac{1}{2}$ mile from shore, and depths of about ten feet lie 500 feet from the beach. Some nearshore reefs are found along the rocky shore northeast of the beach. The beach is exposed to the north, but it is doubtful that wave action is ever heavy. The current offshore of the bay moves eastward, but data are lacking regarding the currents near the beach. There are no tides.

(c) *Landing place.* The beach, which is composed of sand, is about $\frac{1}{2}$ mile long and relatively narrow. The sand is probably fine, becoming increasingly so toward the mouth of a rivulet on the west which, it is reported, carries considerable mud into the bay and has formed a bank several hundred yards from the shore. The surf, which is believed to be very light, breaks over a wide belt with several lines of breakers. A landing place, named Chengene Skele is situated on the beach near sheds and storehouses. There is a well at the east end of the beach.

(d) *Terrain inland and on flanks of beach.* The beach is backed by hills which rise close behind the shore, but to the west is a marshy river flood plain extending inland about a mile, with a lagoon in its center. The hills are covered with forests, locally cut-over. Exit from the beach is provided by a highway which runs close to the shore along the eastern part of the beach, leading westward to Burgaz and eastward to Sveti Nikola.

(23) *Chingani Bay—D.* (Figure III - 26.) Reliability fair.

(a) *Location and extent.* About one mile southeast of Nos Poros (Foros) is a narrow, sandy beach about $\frac{1}{2}$ mile long, its center at latitude $42^{\circ} 26' 50''$ N., longitude $27^{\circ} 29' 20''$ E.

(b) *Nearshore.* The approach to the beach is clear of hazards. The bottom slope is moderate to steep. The 30-foot depth lies 1,600 feet from shore, and the 18-foot depth line lies about 500 feet from shore. The beach is exposed to the northeast. Data are lacking regarding currents near the beach. There are no tides.

(c) *Landing place.* The beach is composed of sand, probably mixed with pebbles. It is $\frac{1}{2}$ mile long and may locally be as much as 200 feet wide. Apparently the beach extends northward for an additional $\frac{1}{2}$ mile as a narrow strand at the base of a bluff, but there is some contradiction in the source data. The foreshore slope is moderate to steep and the sand is firm. The surf, which is believed to be light, breaks over a narrow belt. There is a small pier near the southeastern end of the beach, near which are the buildings of the quarantine officer.

(d) *Terrain inland and on flanks of beach.* The southeastern part of the beach is backed by a limited plain, inland of which moderate slopes rise to hilly country. A road runs behind the beach on this narrow flat, joining the main Burgaz/Sveti Nikola road to the southeast, and running to Nos Poros on the northwest. The hill slopes are forested, the lower portions are cut-over.

(24) *Poros Bay.* (Figures III - 26 and III - 27.) Reliability fair.

(a) *Location and extent.* A wide, sand beach four miles long lies southwest of the port of Burgaz, at the very head of Burgaz Bay. It begins at latitude $42^{\circ} 26' 55''$ N., longitude $27^{\circ} 27' 45''$ E., and ends at latitude $42^{\circ} 29' 15''$ N., and longi-

tude $27^{\circ} 28' 05''$ E. The buildings of the town of Burgaz at the north end of the beach stand on high land overlooking the shore and serve as a landmark. A light is shown from a cylindrical tower 28 feet high on the head of the eastern breakwater in Burgaz harbor one mile east of the north end of the beach.

(b) *Nearshore.* The approach to the beach, through a broad channel, is clear along its southern part, between Poros Pt. (Nos Foros) and a series of shoals lying south of the main harbor breakwater. This channel is dominated by the high land at Poros Pt. and at Burgaz. The 30-foot depth line lies a little more than a mile from the beach, but the 18-foot depth line lies about 1,200 feet off the shore. The bottom material is sand. No reefs occur along the beach proper, but there is a partially submerged wreck offshore near its southern end. The prevailing winds are from the northwestern quarter in winter and from the northeastern quarter during summer. Winds from the east bring on a heavy swell. Wave action is usually light. Data on currents are scarce, but it is reported that there is a south-flowing current east of the port. There are no tides. (Figure III - 27.)

(c) *Landing place.* The beach is four miles long and about 200 to 300 feet wide, grading inland to a dune belt. The foreshore slope is moderate and the sand is firm. The backshore slope is gentle and the sand is somewhat softer. The beach is continuous from its southern end almost to the harbor at Burgaz, where it is interrupted by the outlet of the lagoon, Lake Vaya-Koi (Vaya Koysko Yezero). At its southern end the beach terminates with another lagoon outlet which leads from Lake Mandrensko (Mandrensko Yezero). When waves are running the surf breaks in a relatively narrow belt close to the shore, although during heavy weather there may be several lines of breakers extending some distance out. There are no structures known on the beach.

(d) *Terrain inland and on flanks of beach.* The beach lies on a low, marshy coastal plain between two lagoons. The northern half of the beach is a sandy peninsula which forms the outer shore of the northern lagoon. A belt of dunes of maximum width about $\frac{1}{2}$ mile lies behind the beach. Inland of the dunes are marshy and meadow-like areas. Beyond the plain on which the beach is built the terrain rises westward to a series of hills about 200 meters high. The plain is partly cultivated, the lower slopes of the hills are apparently set out in orchards, and the higher land is forested. Exit from the beach is afforded by a main highway which runs close to the shore at the southeastern end of the beach and is connected by a causeway or bridge across the inlet to the southeast. In this direction the road runs to Sveti Nikola, and a branch runs inland south to Sredets (Zvedets), 25 miles distant, and beyond. The road on the beach runs northward close to the shore for about $\frac{1}{2}$ mile, swings inland to the northwest, then loops to the north and northeast to Burgaz. Near Burgaz a main road branches off, running 35 miles inland southwest to Momina-Tsrkva and beyond.

(25) *Burgaz.* (Figures III - 26 to III - 28.) Reliability good.

(a) *Location and extent.* Beginning at the eastern mole at the foot of the town of Burgaz is a broad, sandy beach extending about $3\frac{1}{2}$ miles northward. It follows a gentle curve from latitude $42^{\circ} 29' 20''$ N., longitude $27^{\circ} 28' 50''$ E. to latitude $42^{\circ} 32' 00''$ N., longitude $27^{\circ} 29' 40''$ E.

(b) *Nearshore.* The bottom slope is gentle off the town

FIGURE III - 28

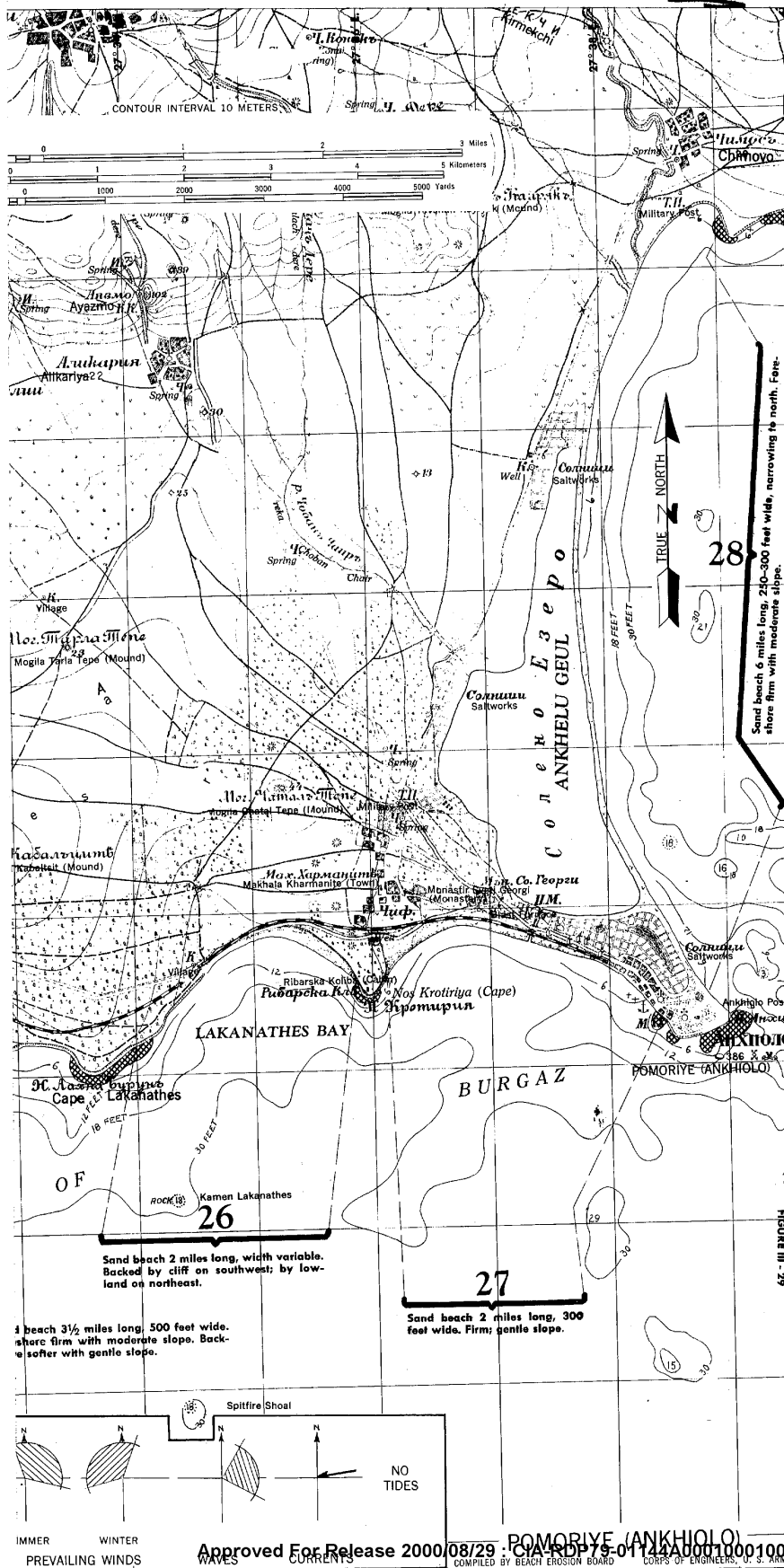
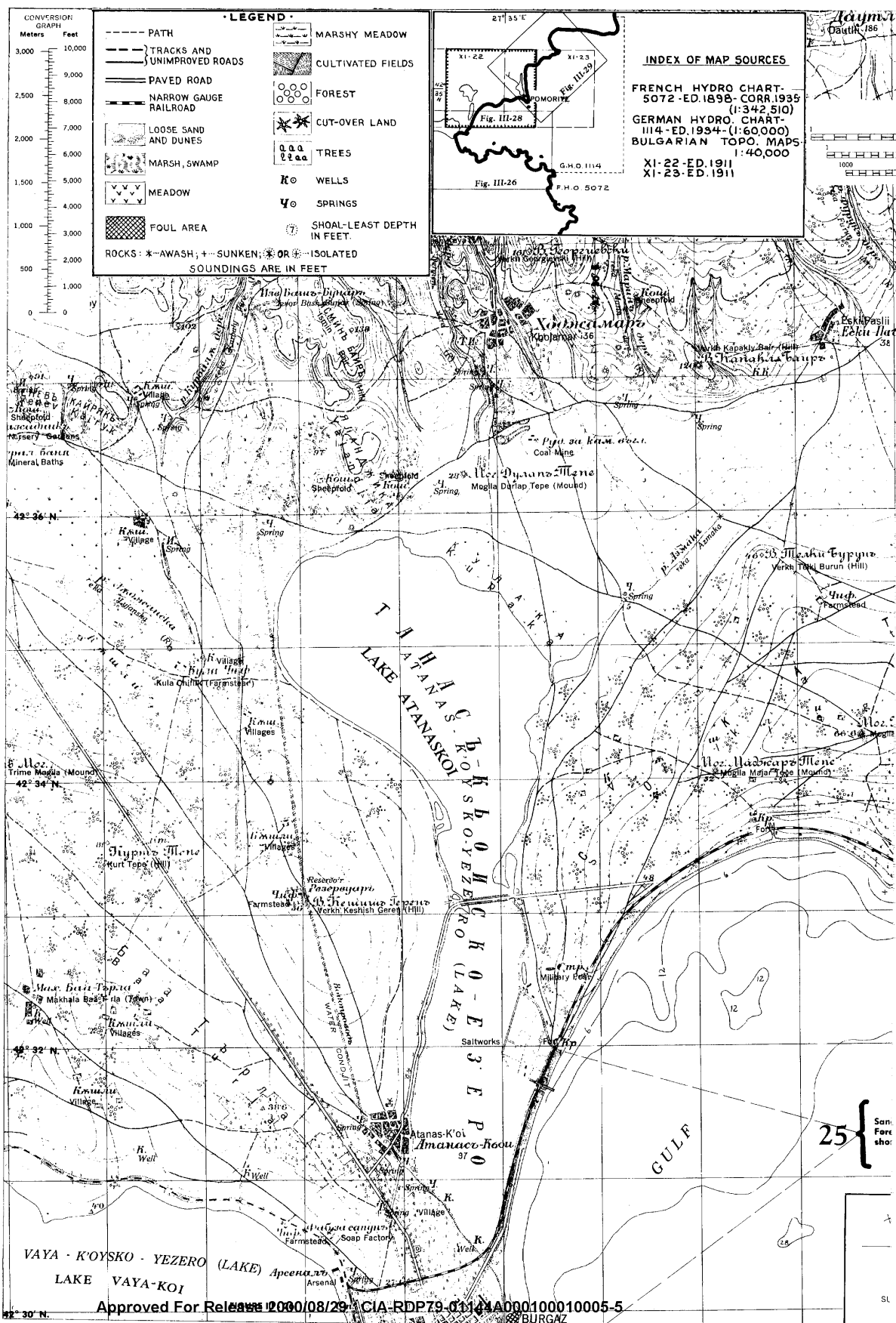


FIGURE III - 29



of Burgaz, and becomes increasingly flatter to the north. The position of the 30-foot depth line varies from $\frac{1}{2}$ mile offshore at Burgaz to more than two miles off the northern end of the beach. Closer to shore the slope is somewhat greater and more uniform; the 18-foot line lies about $\frac{1}{4}$ mile offshore. There are a number of shoal areas in the northern part of Burgaz Bay. Blonde, or Burgaz, Rocks, a shoal lying directly in the approach to the Burgaz beach and about $2\frac{1}{2}$ miles distant, have depths of 28 feet. An extensive area of rocks and reefs lies off the town of Burgaz at the southern end of the beach. The prevailing winds along this beach are from the north-eastern quarter in the summer, and from the northwestern quarter in the winter. Wave action is light, although the beach is exposed to the east and heavy weather from that direction may bring on a swell. There are no tides.

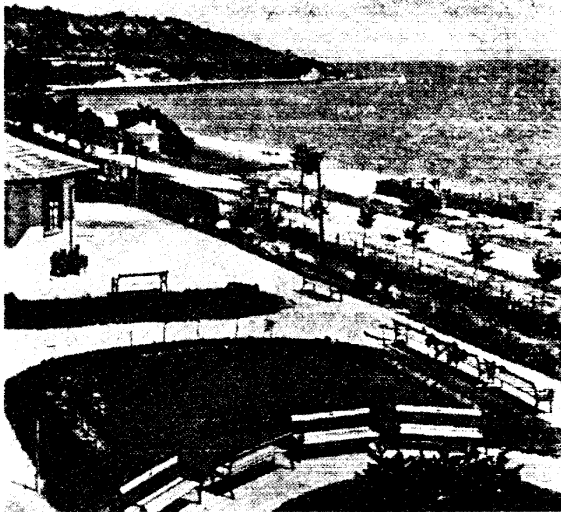


Illustration III - 69. Burgaz.
The bathing beach. Looking north-northeastward toward Cape Lakanathes. Before 1936.

(c) *Landing place.* The beach is about $3\frac{1}{2}$ miles long, 500 feet wide, and is continuous except for an outlet to Lake Atanaskoi (Atanas-Koysko Yezero), a lagoon lying behind the beach. At its southern end the beach is narrow and lies at the foot of the high ground upon which Burgaz is built. (Illustration III - 69.) Northward the beach is a neck of sand about 500 feet wide separating the sea from the lagoon. The foreshore has a moderate to steep slope, and the sand is firm. The backshore is more nearly level and grades inland to wind-blown sand which becomes increasingly soft. When waves are running the surf breaks in a relatively narrow belt close to the shore, although during heavy weather there may be several lines of breakers extending some distance out. The beach butts against the eastern breakwater at Burgaz harbor, and there is a recreation pier and bathhouse along the southern part of the beach below the town about $\frac{1}{2}$ mile north of the harbor (Illustration III - 70). A small jetty extends out from the shore just north of an outlet from Lake Atanaskoi.

(d) *Terrain inland and on flanks of beach.* The southern part of the beach is dominated by the heights at Burgaz, which are

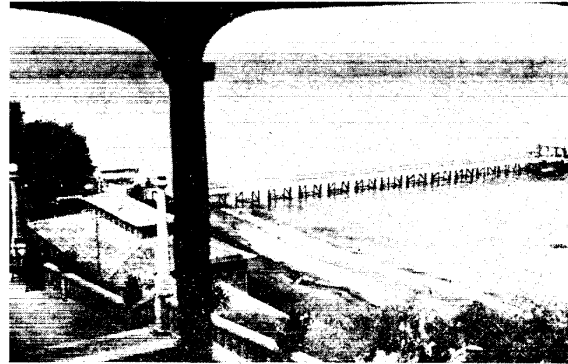


Illustration III - 70. Burgaz.
Waves breaking in a single line on beach north of the harbor. Looking north-northeast from the bathing beach pavilion. Before 1936.

locally 27 meters (90 feet) above the sea. The northern part of the beach is backed by the lagoon previously mentioned, part of which has been laid out in salt pans. The northern end of the beach is also dominated by higher land, which rises in moderate slopes except for a bluff at its edge. This bluff continues along the shore to the northeast with a narrow beach at its foot which may extend for as much as three miles from the main beach. Inland of the lagoon are flood plains which extend westward and northeastward from its northern end. The lowlands are partly cultivated with some orchards and the slopes are brush-covered. Exit from the beach is provided by a highway which runs along the beach where it fronts the lagoon northward to Nesebr (Messemvria). It is paralleled by a railway which runs to Pomoriye (Ankhelu). The southern part of the beach is backed by a bluff; however, exits undoubtedly exist directly into the city of Burgaz. The narrow strand northeast of the main beach may have an exit at the mouth of a small ravine about three miles from the lagoon outlet. This ravine leads to a road on the upland.

(26) *Lakanathes Bay.* (Figure III - 28.) Reliability fair.

(a) *Location and extent.* In Lakanathes Bay (Zaliv Lakhna) lying between Cape Lakanathes (Nos Lakhna) and Cape Krotiriya to the eastward there is a sandy beach about two miles long and fairly wide. It lies about six miles northeast of the town of Burgaz, extending from latitude $42^{\circ} 33' 15''$ N., longitude $27^{\circ} 34' 10''$ E. to latitude $42^{\circ} 33' 30''$ N., longitude $27^{\circ} 35' 50''$ E. It is almost semicircular in shape, following the curving shoreline of the bay, which is indented $\frac{3}{4}$ mile between the capes.

(b) *Nearshore.* The northern part of Burgaz Bay is shoal in many places. It should be entered somewhat to the south; the shoal Spitfire Rocks (Banka Spitfair, Spitfire Shoal) then lies in the approach to the beach, about four miles from it. About one mile east-southeast from Cape Lakanathes is the Lakanathes rock (Kamen Lakanathes), with a least depth of 18 feet over it. The bottom is very gently sloping; the 30-foot depth line is everywhere more than one mile from the beach, and the 18-foot depth line is about $\frac{1}{2}$ mile from shore. The 12-foot depth line lies 500 feet off the western part of the beach, but off the eastern, wider portion of the beach, the bottom slope is gentler, and 12-foot depths are located as much as 1,700 feet offshore. The bottom material is sand and gravel offshore from the 30-foot depth line, changing to sand

near shore. The beach is protected by the high land back of it from the prevailing northwest, north and northeast winds, but southeasterly storms blow directly into it. Offshore currents are generally westward. There are no tides. Strong southeasterly winds probably raise the water level somewhat.

(c) *Landing place.* The sand beach is two miles long and varies in width. The western part is relatively narrow and lies at the foot of a cliff, while the eastern part is 200 to 300 feet wide slightly east of the center of the bay, narrowing eastward as the bluff backing it approaches the sea. There are no interruptions to the beach. The foreshore is firm with a gentle to moderate slope. The backshore is softer with a gentle slope becoming flatter in the northeastern part. The surf is generally light. When waves are running they break over a broad band, but they are probably heavy only during southeast storms. Shore drift is slight but generally eastward.

(d) *Terrain inland and on flanks of beach.* Gentle slopes rise as a broad plain back of the beach to the foot of the hills five miles northward. In the vicinity of the beach this plain is extensively cultivated. The beach is directly backed at its north end by a cliff which is gradually dissipated to the northeast, then is continued as a low bluff on the northeast end, which lies back of a belt of wind-blown sand about 200 feet wide separating it from the beach proper. Along the edge of this cliff and bluff is a highway which runs eastward $2\frac{1}{2}$ miles to Pomoriye (Ankhiolo), and westward eight miles to Burgaz. Near the northern end of the beach a track or trail provides exit to a network of roads on the coastal plain and inland of it. A narrow-gauge railway runs close behind the beach near its central part, connecting Burgaz and Pomoriye.

(27) *Cape Krotiriya (Nos Krotiriya).* (Figure III - 28.) Reliability fair.

(a) *Location and extent.* The bay eastward of Cape Krotiriya is lined with a wide sand beach more than two miles long extending from the cape to the foot of the town of Pomoriye. It begins at latitude $42^{\circ} 33' 35''$ N., longitude $27^{\circ} 36' 10''$ E., and ends at latitude $42^{\circ} 33' 20''$ N., longitude $27^{\circ} 38' 20''$ E. Conspicuous buildings in Pomoriye form good landmarks. A light is shown from a masonry tower on the reef southeast of Pomoriye.

(b) *Nearshore.* The bottom slope off this beach is gentle but irregular. Depths less than 30 feet extend seaward in long fingers as much as $2\frac{1}{2}$ miles from the shore. One of these includes Ankhiolo or Ankhelu Bank nearly two miles south of the eastern end of the beach, with a least depth of 19.5 feet. The bottom is composed of sand and silt. Nearshore rocks and reefs are found only beyond the ends of the beach. Anchorage in the bay is good during north and northeast winds, but east or southeast winds raise a heavy sea, with waves breaking more than a mile from shore. Few data are known regarding offshore currents, but they are generally westward. There are no tides. Strong southeast winds probably cause a rise in the water level.

(c) *Landing place.* The sandy beach is more than two miles long and 300 feet or more in width. It is interrupted at its center by an outlet to Ankhelu Geul or Salt Lake (Soleno Yezero), $\frac{1}{4}$ mile inland. The foreshore is firm with a gentle to moderate slope; the backshore is softer and essentially flat. When waves are running the surf covers a wide band fronting the beach with many lines of breakers. Shore drift is slight and eastward. A small mole extends from the east end of the beach.

(d) *Terrain inland and on flanks of beach.* Back of the beach is a strip of wind-blown sand, covered with grass and brush. The beach forms the southern boundary of a sandy neck connecting the headland of Pomoriye with the mainland. To the east is relatively high land with the town upon it. North-eastward is the lagoon Ankhelu Geul extending about three miles northward. Northwestward the coastal plain slopes gently inland to hills five miles distant. A highway runs a short distance back of the beach, eastward into the town of Pomoriye, westward to Burgaz a distance of about 12 miles. The sandy neck inland of the beach proper is a veritable bottleneck of roads, which converge from all directions toward the town of Pomoriye. A narrow-gauge railroad from Burgaz runs close behind the beach to Pomoriye. The exact position of the track is not known but it is believed to be located with fair accuracy on the map.

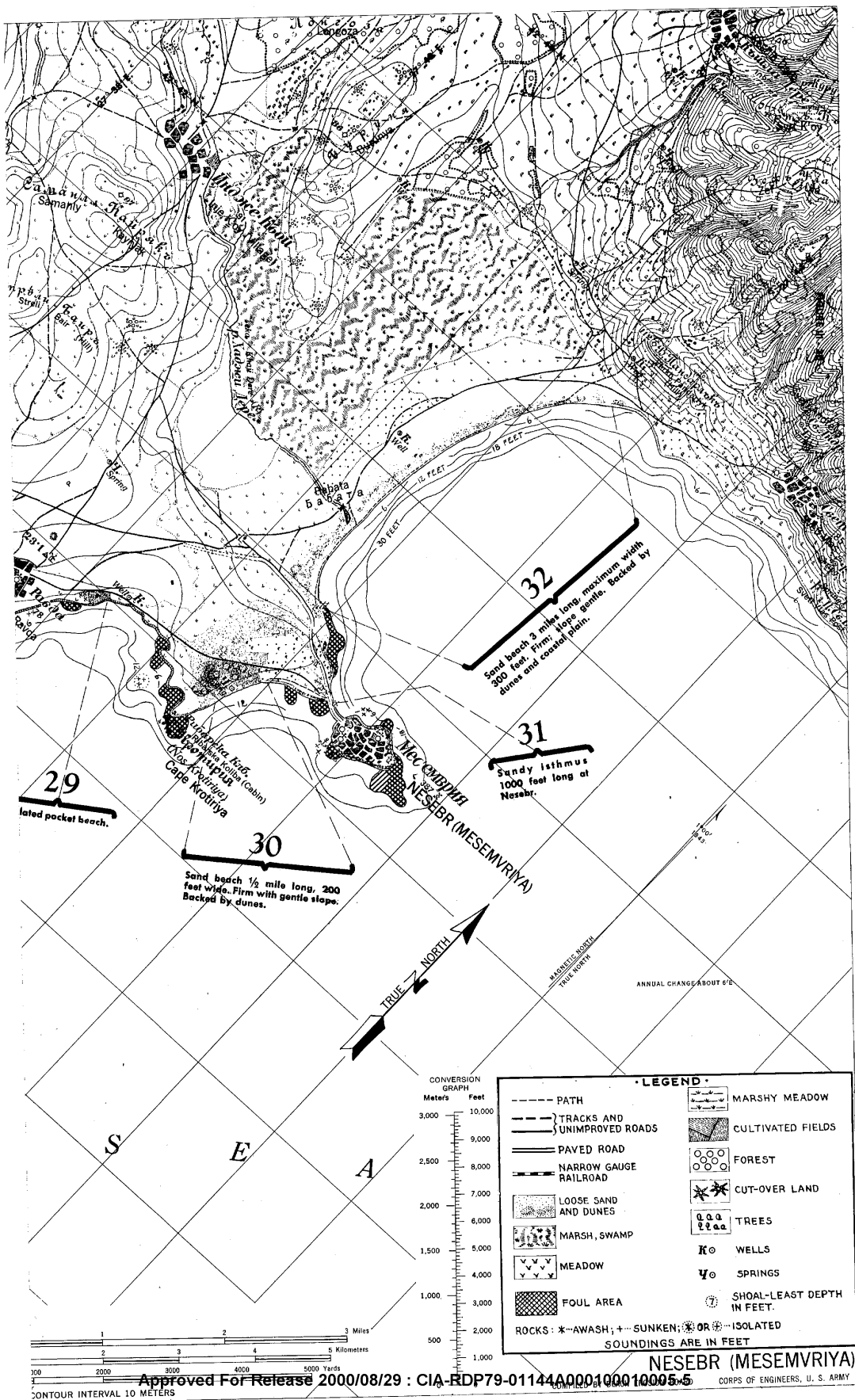
(28) *Pomoriye (Ankhiolo, Ankhelu).* (Figures III - 28, III - 29.) Reliability fair.

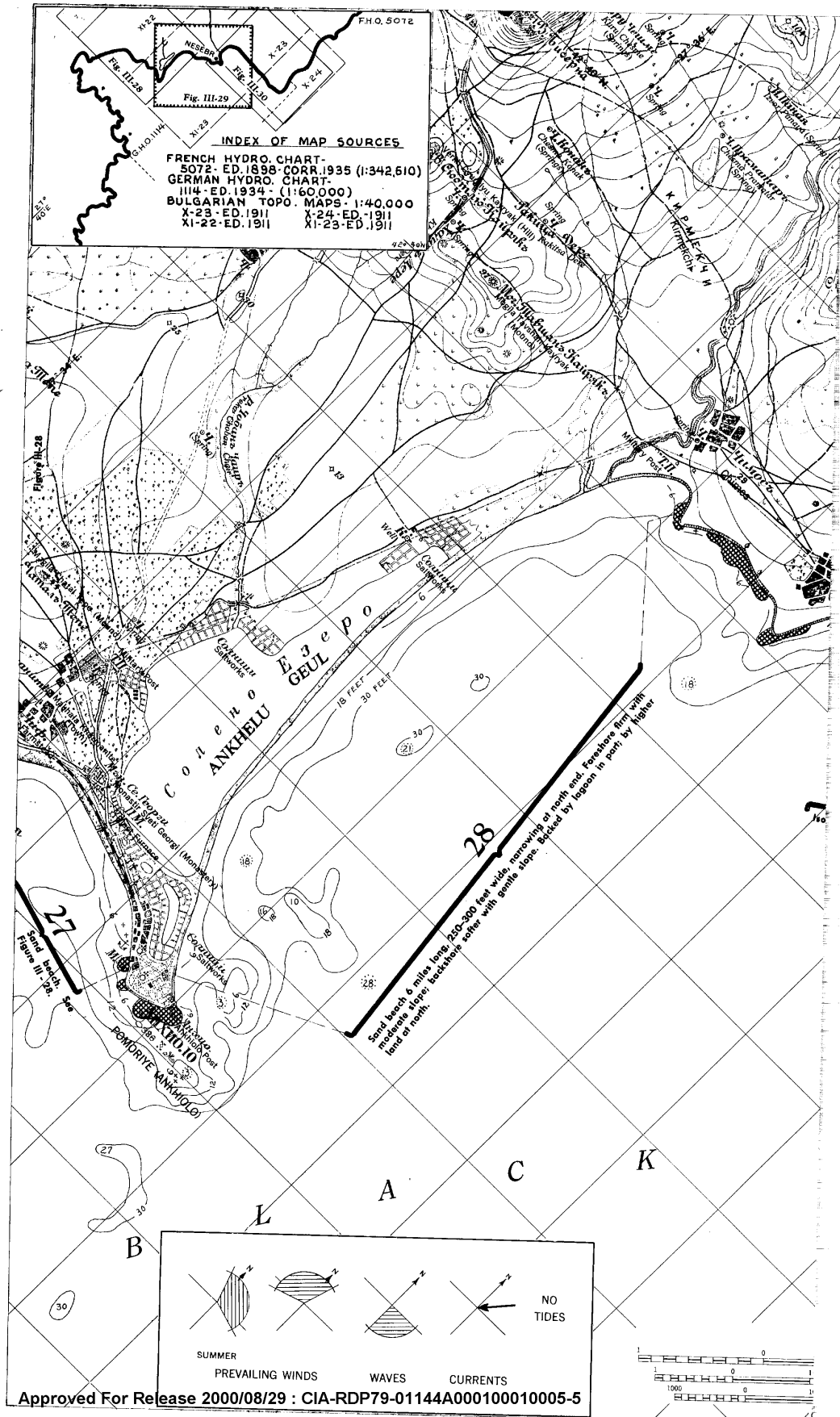
(a) *Location and extent.* From the east side of the town of Pomoriye northward for about six miles the shore is bordered by a sandy beach fairly wide and gently curved. It begins at latitude $42^{\circ} 33' 30''$ N., longitude $27^{\circ} 38' 30''$ E., and ends at latitude $42^{\circ} 38' 20''$ N., longitude $27^{\circ} 39' 00''$ E. Prominent buildings in Pomoriye provide conspicuous landmarks for the southern end of the beach. A light is shown from a masonry tower on the reef southeast of Pomoriye.

(b) *Nearshore.* The bottom slope up to the beach is fairly gentle. The 30-foot depth line lies generally within $\frac{1}{2}$ to $\frac{1}{4}$ mile of the shore, the 18-foot line lying approximately halfway between. A series of shoal areas about a mile off the beach complicate the approach. Off the southern end of the beach depths are very irregular in the vicinity of the Northeast Ankhelu Reef (N. O. Ankhiolskii Rif), where 30-foot depths are found $1\frac{1}{4}$ miles out to sea. Northward of this reef are two detached shoals each a little less than a mile from the shore. The beach is somewhat sheltered from north and northeast winds and waves, particularly in its northern portion, but is open to the east and completely exposed to southeast storms, which bring heavy seas. Little is known of the offshore currents except that their direction is generally southwestward. There are no tides. Southeast storms probably raise the water level.

(c) *Landing place.* The beach is 250 to 300 feet wide and six miles long. It is composed of firm sand which may have a soft surface in the backshore area. The foreshore slope is moderate; the backshore slope, gentle. For most of its length it constitutes a barrier beach separating the $3\frac{1}{4}$ -mile lagoon Ankhelu Geul or Salt Lake (Soleno Yezero) and adjoining salinas from the sea. The surf is moderate in intensity, heaviest during southeast storms. The waves break over a wide belt in several lines of breakers. The direction of shore drift is variable, with the preponderance probably from north to south.

(d) *Terrain inland and on flanks of beach.* The southern end of the beach is backed for $\frac{3}{4}$ mile by salt pans. Then for $3\frac{1}{4}$ miles the lagoon Ankhelu Geul lies directly in back of the beach, followed by another $\frac{1}{4}$ -mile salina. Only the $1\frac{3}{4}$ miles at the northern end is open to egress to the interior. A bluff begins to rise back of the beach about $\frac{3}{4}$ mile north of the northern salt pan area, rising gradually around the little bay at the north end of the beach. The bluff rises to a cliff eastward for about two miles in a direct line from the northern end of the beach. There are numerous small rocky pocket beaches in





this stretch, apparently without exits, and commanded by the cliff. Inland of the beach and lagoon is a broad coastal plain with a gradual slope to the interior hills. In its southern part it is cultivated, but is apparently largely grass-covered in the north. Pomoriye in the south is connected with the village of Chimovo (Chemose, Chimos), $\frac{1}{2}$ mile inland of the northern part of the beach, by a road running inland of the lagoon. Apparently this road is easily reached from the beach north of the lagoon, which it parallels at a distance of about $\frac{1}{4}$ mile. From the very southern end of the beach exit may be made by way of the streets of Pomoriye to roads running inland in all directions. A narrow-gauge (60 cm.) railway line connects Pomoriye with Burgaz.

beach is clear, although there are rocks and reefs extending from both points southwest and northeast of the beach. From the southwestern point a reef extends about $\frac{1}{2}$ mile seaward. Anchorage is good in the bay, sheltered somewhat from north and northeast prevailing winds and waves, but open to southeast storms. Waves approach from the southeast, and may be dangerous during storms from that direction. Little is known regarding the currents, but in general they apparently move southwestward here. There is no tide. Southeast winds probably raise the water level somewhat.

(c) *Landing place.* The beach is composed of sand, and is about $\frac{1}{2}$ mile long and 150 to 200 feet wide. The foreshore is firm with a moderate slope. The backshore is softer, with



Illustration III - 71. Nesebr.

Looking west over village on peninsula. Sandy isthmus and mainland in the background. Light on tower at extreme right.

(29) *Ravda.* (Figure III - 29.) Reliability fair.

A small pocket beach lies northeast of Ravda about $1\frac{1}{2}$ miles, its center at about latitude $42^{\circ} 39' 00''$ N., longitude $27^{\circ} 41' 20''$ E. Although there is a road near the top of the bluff behind it leading to the village of Ravda, exit is apparently not easy.

(30) *Nesebr (Mesemvriya, Messemvria)*—A. (Figures III - 29, III - 30.) Reliability fair.

(a) *Location and extent.* A little more than $\frac{1}{2}$ mile southwest from Nesebr is a sandy bathing beach about $\frac{1}{2}$ mile long and 200 feet wide, facing southeastward. Its center lies at latitude $42^{\circ} 39' 10''$ N., longitude $27^{\circ} 42' 50''$ E.

(b) *Nearshore.* The bottom slope up to the beach is moderate, the 30-foot depth line lying about $\frac{1}{2}$ mile from the shore and the 18-foot line less than halfway inland from it. The bottom material is sand and shells. The approach to the

a gentle slope. The surf covers a fairly wide area with several lines of breakers. Shore drift is generally toward the northeast. There are no structures on the beach. A spring is located south of the center of the beach.

(d) *Terrain inland and on flanks of beach.* The beach is immediately backed by dunes and wind-blown sand which extend inland for some distance over gently rising slopes. Toward Nesebr the slopes are cultivated but otherwise covered lightly with scattered grasses. A road between Ravda $1\frac{3}{4}$ miles to the west and Nesebr $\frac{1}{2}$ mile to the northeast lies about $\frac{1}{4}$ mile inland from the beach, somewhat closer at the northeast end.

(31) *Nesebr (Messemvria)*—B. (Figures III - 29, III - 30.) Reliability fair.

(a) *Location and extent.* The town of Nesebr (Illustration III - 71) (population 1,000) lies on a rocky headland con-

nected to the mainland by a sandy neck about 1,000 feet long, and varying in width from 250 to 300 feet. The coordinates of its center are latitude 42° 39' 30" N., longitude 27° 44' 00" E. A light is shown $\frac{1}{4}$ mile southwest from the Nesebr church on a stone tower.

(b) *Nearshore.* The sandy neck (Illustration III - 72) trends in an east-west direction and may be approached from the north or south. The bottom slope is approximately the same on both sides; it is moderate, the 30-foot depth line lying about $\frac{1}{4}$ mile offshore, the 18-foot line at about half that distance. The approaches to both the north and south beaches are clear, although rocks and shoals are located at both ends of both beaches. Anchorage is said to be better off the south beach because it is more protected from squalls which during northerly winds blow violently from Mount Emine (Yemona, Yemine, Eminch). Waves approach from the northeast to the northern beach, from the southeast to the southern beach. Little is known of the currents, but they flow in a general southwesterly direction off Nesebr. There are no tides.



Illustration III - 72. Nesebr.

Close view, looking east, of the sandy isthmus which connects the mainland in foreground and the Nesebr peninsula in background. Before 1933.

(c) *Landing place.* Both beaches are approximately 1,000 feet long and together form a neck 250 to 300 feet wide. The beaches are composed of sand, firm, and with a foreshore of moderate slope, the backshore being essentially flat. It is reported that the whole isthmus is sometimes covered by the sea. When waves are running the surf is composed of several lines of breakers spread over a fairly wide belt. Shore drift is generally toward the town of Nesebr. A road traverses the isthmus from the mainland into the town. The stone tower which shows a light is located at about the center of the northern beach. (Illustration III - 71.)

(d) *Terrain inland and on flanks of beach.* The isthmus is terminated at the east by the high land upon which Nesebr is built, and on the west by the overlooking bluffs of the mainland. Atop the bluffs is a gently sloping plain. The road leading from Nesebr branches upon the mainland; one branch, mediocre but metalled, leads east and southward to Pomoriye about 12 miles distant; one north and westward to Emine (Yemona, Yemine) somewhat farther away. Close to Nesebr the land is cultivated; farther inland it is dune-covered, changing to prairie land toward the interior.

(32) *Nesebr (Mesemvriya)*—C. (Figures III - 29, III - 30.) Reliability fair.

(a) *Location and extent.* Northwest of the town of Nesebr

about $\frac{3}{4}$ mile a beach begins at latitude 42° 40' 00" N., longitude 27° 42' 50" E. and extends in a gently curving arc three miles northward to latitude 42° 42' 25" N., longitude 27° 43' 30" E. This sandy beach is about 250 feet wide and rises inland to a broad dune belt.

(b) *Nearshore.* The bottom slope is moderate; the 30-foot depth line lies generally a little more than $\frac{1}{4}$ mile from the shore, with the 18-foot line somewhat closer to it than to the shore. The bottom material is generally sand, but muddy or rocky in some places seaward of the 30-foot depths. Anchorage is good all over the bay north of Nesebr, except that there is no shelter from severe squalls which occasionally blow from the north. The bay is also open to strong winds from the east, but the sea is reported to be usually calm. Wave approach is from the east; during easterly gales wave action is heavy. Few data are available on the currents, which in general flow in a southwesterly direction past Nesebr in the offshore region. There are no tides. Strong easterly winds may raise the water level somewhat.

(c) *Landing place.* The beach is about three miles long and 250 to 300 feet wide. It is composed of sand, firm in the foreshore area, softer on the backshore. The foreshore slope is moderate, the backshore has a gentle slope, rising somewhat toward the dunes at the back of the beach. The stream Hadzhidere (Khadzhi-Dere, Reka Khaji Dere) crosses the beach $1\frac{1}{2}$ miles from Nesebr and constitutes the only interruption to its continuity. When waves are running the surf covers a belt of moderate width, the breakers rising in several lines. Shore drift is predominantly southward toward Nesebr.

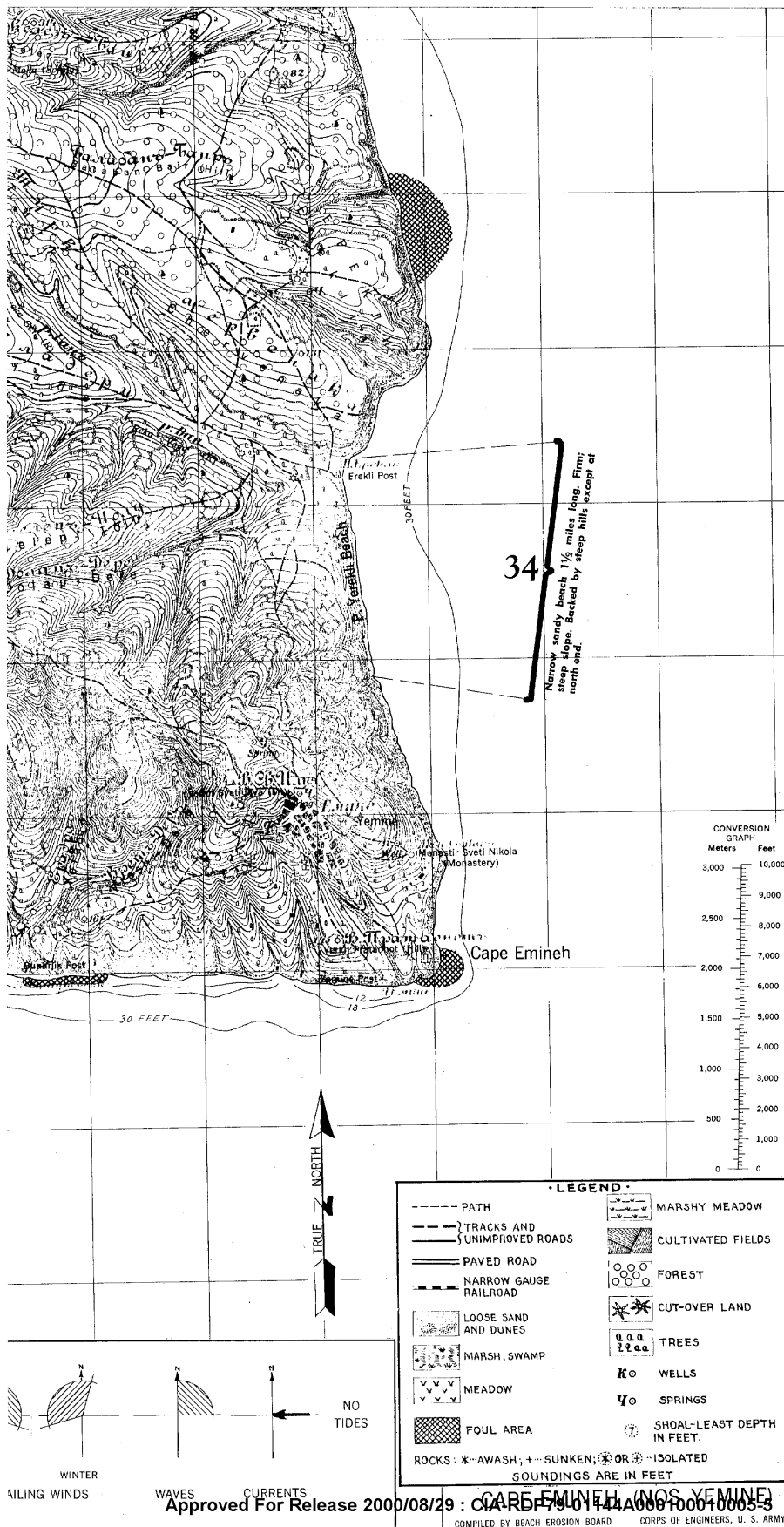
(d) *Terrain inland and on flanks of beach.* The belt of dunes and wind-blown sand back of the beach is in places more than $\frac{1}{4}$ mile wide. The sand drifts generally southward and crosses the point of land from which Nesebr extends, joining the sandy terrain back of the beach southwest from that town. The beach borders a broad coastal plain sloping gently upwards inland from a swampy area one to two miles wide. A road extends parallel to the shore close back of the dune area. To the south it connects with a road leading to Nesebr, about $\frac{3}{4}$ mile distant. To the north it swings eastward along the shore to Emine on Cape Emine (Nos Yemine), about 10 or 12 miles distant.

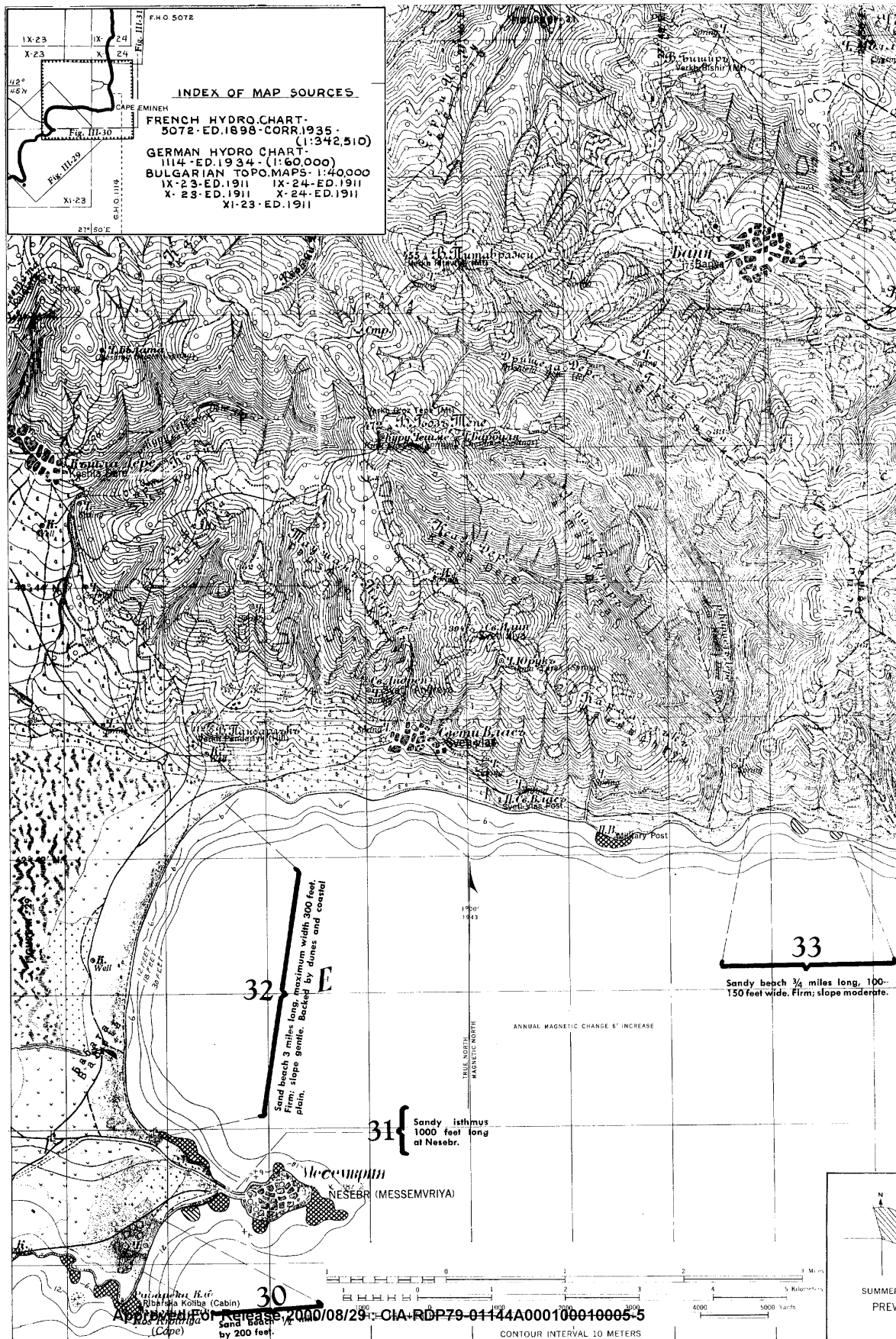
(33) *Hadzhidere (Khadzhi-Dere, Reka Kariez Dere).* (Figure III - 30.) Reliability fair.

(a) *Location and extent.* West-southwest from the village of Emine is a narrow beach about $\frac{3}{4}$ mile long of sand and gravel. A short distance west of it is the mouth of the stream Hadzhidere. The center of the beach lies at about latitude 42° 42' 15" N., longitude 27° 49' 15" E.

(b) *Nearshore.* The bottom slope off this beach is moderate, the 30-foot depth line lying nearly $\frac{1}{2}$ mile from the shore, the 18-foot depth line about halfway between. The bottom is composed of sand. There are no rocks or shoals in the offshore approach to the beach, but there are rocks along the beach near its eastern end. The beach itself is sheltered from the prevailing winds, but northeasterly squalls may kick up a sea in the approach. It is wide open to southeasterly storms. Wave approach is directly from the south, even with northeast to southeast winds. Offshore currents flow generally westward. There is no tide. Southeast storms cause some rise in the water level.

(c) *Landing place.* The beach is $\frac{3}{4}$ mile long and 100 to 150 feet wide. It is composed of sand and gravel with prob-





ably some much coarser material. Several very small streams cross it, but these can hardly be said to interrupt its continuity. The foreshore is firm with a moderate to steep slope; the backshore is also firm, with a moderate slope. The surf covers a moderately wide belt with several lines of breakers. Shore drift is slight and to the westward.

(d) *Terrain inland and on flanks of beach.* The beach is immediately backed by the steep forest covered slopes of the mountainous cape, Emine. A road lies close along the back of the beach; it is at a considerable elevation and probably would be difficult for men and impossible for vehicles to attain. It leads westward through the small village of Svetivlas, about three miles distant, swinging eventually southward and southeastward to Nesebr, 10 or 12 miles away. Eastward it runs to Emine some four miles distant but is of poor quality.

(34) *P. Yerekli.* (Figure III - 30.) Reliability fair.

(a) *Location and extent.* A narrow, sandy beach about $1\frac{1}{2}$ miles long lies two miles north of Cape Emine. The beach lies between latitude $42^{\circ} 43' 55''$ N. and latitude $42^{\circ} 45' 20''$ N. at about longitude $27^{\circ} 53' 25''$ E. A landmark for the beach is Cape Emine itself, a bold headland with a monastery on it. A light is shown from a white tower at an elevation of 207 feet at the end of the cape.

(b) *Nearshore.* The sea approach to the 30-foot depth is clear. This depth lies about $\frac{3}{4}$ mile offshore. No nearshore hazards are known along the beach. The bottom offshore is sand and mud. The prevailing winds along this coast are from the northeastern quarter during summer and from the northwestern quarter during the winter. Waves approach mainly from the northeastern quarter, but storm waves arrive from the southeast. The current along the coast flows northward. There are no tides.

(c) *Landing place.* The beach, which is $1\frac{1}{2}$ miles long and relatively narrow, is composed of sand and pebbles. The beach is nearly straight and faces to the east. Near its northern end the beach widens at the mouth of Reka Gan, or Reka Vaya, a small stream which enters the sea near P. Yerekli. The foreshore slope of the beach is steep and firm. The backshore, especially near the stream mouth, is much flatter and somewhat softer. Surf breaks in a narrow belt close to shore. The shore drift is variable, with a preponderance of movement toward the south. There are no structures on the beach.

(d) *Terrain inland and on flanks of beach.* The beach is backed by steep slopes which rise immediately behind the beach to hilly country dissected by ravines and valleys. A trail runs immediately behind the beach along its entire extent, affording an exit to P. Yerekli, where trails lead inland. One of these trails leads to the town of Emine, situated on high land a short distance north of Cape Emine. The lower land along the valley at the north end of the beach is cultivated, but the higher slopes of the hills are forested.

(35) *Obzor (Gozezen).* (Figure III - 31.) Reliability fair.

(a) *Location and extent.* Starting at the town of Obzor (Gozezen), about eight miles north of Cape Emine, is a sandy beach $3\frac{1}{2}$ miles long, which extends northward to Cape Akdere (Nos Atanas, Atanas Burnu). The southern end of the beach lies at latitude $42^{\circ} 48' 45''$ N., longitude $27^{\circ} 53' 10''$ E., the northern end at latitude $42^{\circ} 51' 20''$ N., longitude $27^{\circ} 54' 10''$ E.

(b) *Nearshore.* The offshore bottom slope is steep in front

of the beach, especially in its northern part. Along the southern half of the beach the 30-foot depth lies about $\frac{1}{2}$ mile from shore. The bottom material is sand and mud. The beach is clear of nearshore hazards, but reefs occur along Cape Akdere, north of the beach. Anchorage may be had southeastward of this latter cape during offshore winds. The prevailing winds in the area are light and variable during the summer and from the northwestern quarter during winter. Waves approach prevailing from the northeastern quarter. Offshore currents flow northward. There are no tides.

(c) *Landing place.* The beach is several hundred feet wide in its southern portion, becoming narrower to the north, especially in the last $1\frac{1}{2}$ miles where it is backed by a bluff. The beach is gently curved, facing eastward on the south and southward at its northern end. The beach is composed of sand, probably mixed with pebbles. The foreshore has a moderate to steep slope and is firm. The backshore is flatter and somewhat softer, especially near the mouths of two streams near the center of the beach. The surf breaks close to shore over a narrow belt, but may widen to a broader zone near the river mouths. Nearshore drift is not pronounced but apparently is to the southward. There are no structures on the beach. Offshore bars can be expected at the river mouths.

(d) *Terrain inland and on flanks of beach.* Inland of the beach at its southern end lies the town of Obzor (Gozezen), which rises on the side of a hill. Northward the inland terrain widens out to the combined flood plains of the Reka Panair Dere and Reka Perperi Dere, which extend inland as a forked plain for several miles. Northward of the river plains the higher land approaches close to shore, forming a cliff or bluff behind the beach. The valley bottom is cultivated and the lower slopes are covered with vineyards and fruit trees. The surrounding hills are forested with oak and beech. Exit from the beach is provided by a trail which runs along its inner edge from the town of Obzor northward to the northern side of the river plain. Here the trail rises over the slopes toward Bela. Approach to the town of Obzor is apparently possible directly from the beach. A road runs inland from the town along the southern river valley.

(36) *Bela (Aspros).* (Figure III - 31.) Reliability fair.

(a) *Location and extent.* A small beach lies at the mouth of a stream in front of the town of Bela (Aspros), located slightly more than a mile north of Cape Akdere (Atanas Burnu). Bela itself lies on the hillslopes on both sides of the valley. The beach extends for a short distance on both sides of the stream mouth, and probably totals no more than $\frac{1}{2}$ mile in length. The center of the beach is at latitude $42^{\circ} 52' 20''$ N., longitude $27^{\circ} 53' 50''$ E. A landmark for the area is Cape Aspro (Nos Aspros), a dark cape covered with wood and brush, lying less than one mile north of the beach. This cape has a white point on it which may be seen for a considerable distance. A wooded hill above the town of Bela is also conspicuous from seaward.

(b) *Nearshore.* The offshore bottom slope in front of the beach is moderately steep, with the 30-foot depth line lying about 1,600 feet from shore. Northward, however, the 30-foot depth line departs farther from shore around Cape Aspro. No nearshore hazards are known along the beach. The prevailing winds in this area are light and variable during summer and from the northwestern quarter during winter. Waves approach prevailing from the northeast quarter. The offshore current flows northward. There are no tides.

(c) *Landing place.* The beach at the ravine mouth is composed of sand and pebbles. The foreshore slope is moderate to steep and the beach is firm. The beach faces toward the east and is exposed to the prevailing waves. The surf breaks in a narrow zone relatively close to shore, although there may be more than one line of breakers opposite the stream mouth. Bars occur off the stream mouth. No structures occur on the beach, although the map shows a building which may be on the beach along the shore a short distance north of the ravine.

(d) *Terrain inland and on flanks of beach.* The beach is backed by moderate to steep slopes; behind its widest portion is a small stream valley which leads upward to the town of Bela. No trails are shown from the beach, but one may connect the building along the shore with the town. The high land which dominates the beach has apparently been cut over and is partly cultivated.

(37) *Verkh Burnis.* (Figure III - 31.) Reliability fair.

(a) *Location and extent.* Starting $\frac{1}{2}$ mile north of Bela is a sand and pebble beach two miles long, averaging from 100 to 200 feet wide. The beach begins at latitude $42^{\circ} 53' 30''$ N., longitude $27^{\circ} 54' 00''$ E., and ends at latitude $42^{\circ} 55' 10''$ N. and longitude $27^{\circ} 53' 45''$ E. A landmark for the beach is Cape Aspro, a dark cape covered with wood and brush, but having a white point on it which may be seen for a considerable distance. This cape lies less than $\frac{1}{2}$ mile from the southern end of the beach.

(b) *Nearshore.* The offshore bottom slope is steep in front of the beach. Detailed hydrography is lacking but the 30-foot depth line, which lies more than a mile from shore at Cape Aspro, swings in toward shore along the beach. No nearshore hazards are known along the beach. The prevailing winds are variable during summer and from the northwestern quarter during winter. Waves approach prevailing from the northeast. The current offshore flows northward. There are no tides.

(c) *Landing place.* The beach, composed of sand and pebbles, is two miles long and has an average width of about 150 feet. The foreshore slope is moderate to steep and the beach is firm. The backshore, best developed near several stream mouths, is much flatter and somewhat softer. The beach faces toward the east and is exposed to the prevailing waves. The surf breaks relatively close to shore in a narrow belt. Nearshore drift is generally southward. No structures occur along the beach. Offshore bars are present.

(d) *Terrain inland and on flanks of beach.* The beach is backed by moderate to steep slopes rising inland to hilly terrain. Two small hills with elevations of 80 and 84 meters dominate the southern and central parts of the beach. Four small valleys or ravines lead up the slopes and are crossed by trails at intermediate elevations.

(38) *Reka Golema Kamchiya.* (Figures III - 31, III - 32.) Reliability fair.

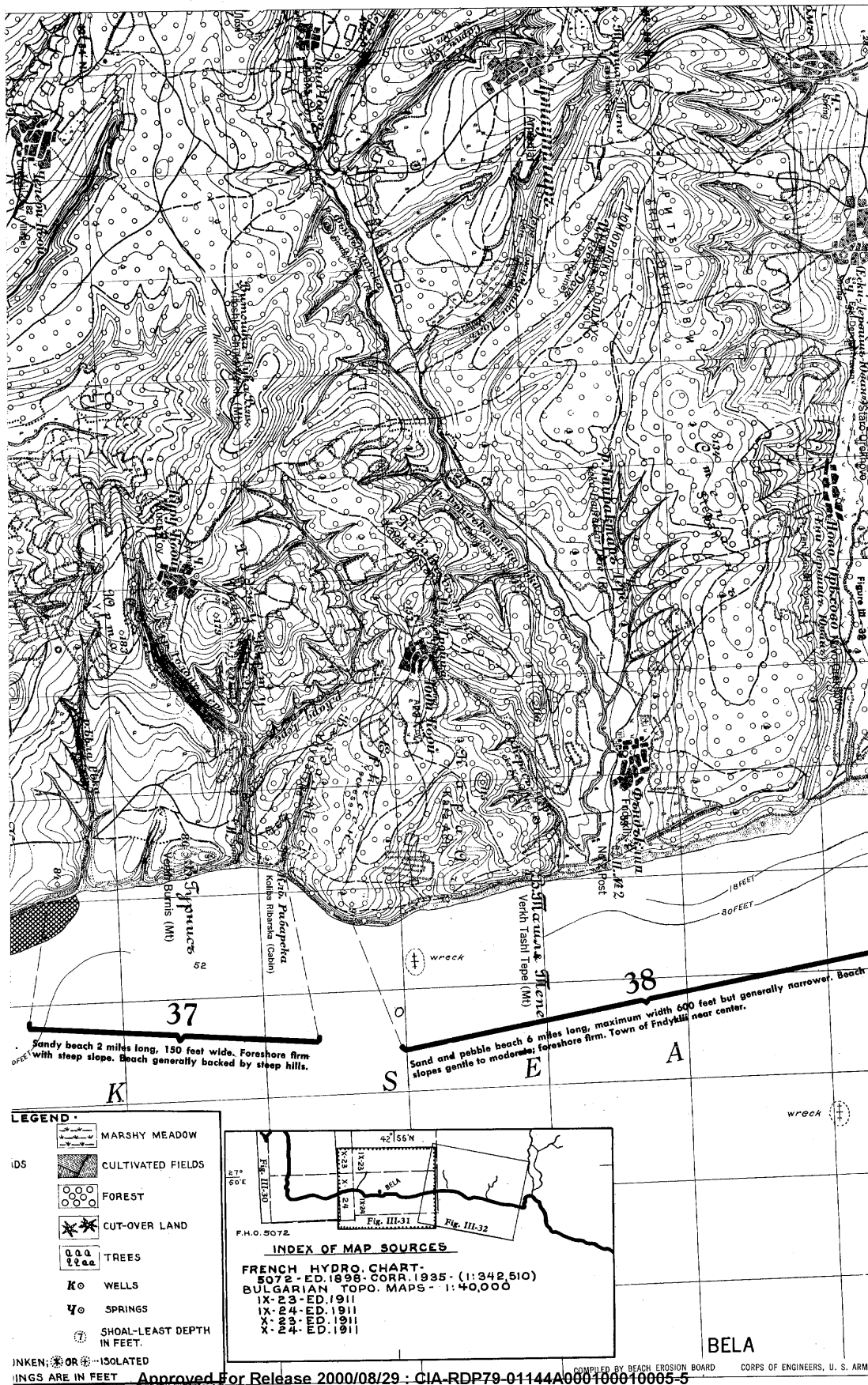
(a) *Location and extent.* A beach about six miles long extends southward from the mouth of the river, Reka Golema Kamchiya, which is located about 22 miles north of Cape Emine. The beach varies in width up to 600 feet or more and is composed of sand. Its southern end is at latitude $42^{\circ} 55' 40''$ N., longitude $27^{\circ} 54' 20''$ E., and its northern end is at latitude $43^{\circ} 01' 20''$ N., longitude $27^{\circ} 53' 20''$ E. The area may be recognized by the broad, wooded plain which here breaks through the hills and white cliffs. The river winds along the

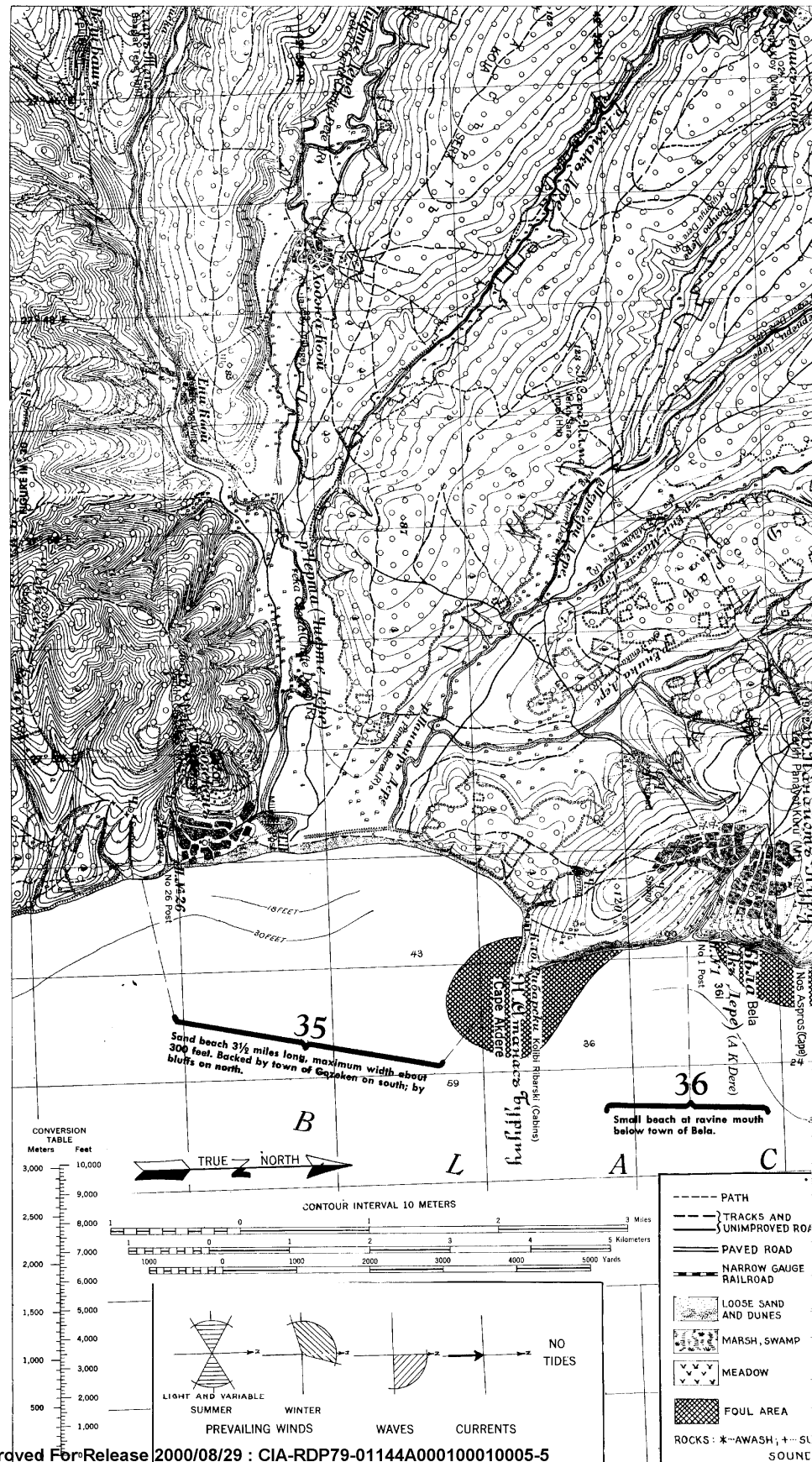
northern edge of this plain and enters the sea at the northern edge of the beach.

(b) *Nearshore.* The offshore bottom slope in front of the beach is uniform and moderately steep. The 30-foot depth lies about 2,000 feet from shore along the southern part of the beach, but swings away near the northern end to a distance of about one mile from shore. The bottom material offshore is sand with patches of gravel and mud. At the river mouth is a bar with a depth of two to three feet, but inside the bar is a depth of 16 feet for more than a mile above the entrance. Good anchorage is found off the mouth of the river $\frac{1}{4}$ miles from shore in ten fathoms on a mud bottom. Large vessels should not approach closer than about a mile from shore, owing to the presence of a bank of rock and gravel with depths of 15 and 18 feet on it, and depths of about 42 feet within. The prevailing winds along this coast are variable during the summer and from the northwestern quarter during winter. Waves approach prevailing from the northeastern quarter. Offshore currents along the beach flow northward. There are no tides.

(c) *Landing place.* The beach is composed of sand mixed with some pebbles. Its total length is about six miles, but is interrupted for a short distance by a bluff about $1\frac{1}{2}$ miles south of the river mouth. The width of the beach varies from about 100 feet near its southern end to a maximum of about 600 to 700 feet near the southern edge of the Reka Golema Kamchiya plain. The foreshore, which is relatively narrow, has a moderate slope and is firm. The backshore, much wider generally, is nearly flat and soft. Some windblown sand may be present along the inner edge of the beach. The beach is nearly straight and faces to the east. It is exposed to the prevailing waves along this shore. The surf breaks in a belt of moderate width near the shore, but near the main river mouth the surf belt widens on offshore bars. In heavy weather breakers may occur on the bank offshore. Shore drift is predominantly toward the south. There are no structures on the beach.

(d) *Terrain inland and on flanks of beach.* The terrain inland of the beach varies along its extent. Near the southern end, for about $1\frac{1}{2}$ miles, the country rises in moderate to steep slopes to hilly country. Opposite the town of Funduklee (Fndyklij), however, the narrow flood plain of the Funduklee (Reka Fndykliyska) extends to the sea and affords a lowland route to the interior. North of here the slopes behind the beach increase again until the broad plain of Reka Golema Kamchiya is reached. This plain is more than two miles broad and runs inland beyond the map edge. The river itself flows along the northern margin of the plain. About two miles inland along its southern edge is a marshy tract with a pond. The river plain appears to be slightly elevated above the beach along much of its extent, so that a low bluff backs the beach. The map suggests that this bluff extends to the sea in one or two places. North of Reka Golema Kamchiya the beach may continue for an additional mile as a narrow strand at the foot of the cliffs. Exits from the beach are provided by a trail which runs along the beach south of the town of Funduklee, as well as by a trail which leads across the main river plain southward from the mouth of Reka Golema Kamchiya. Roads lead inland from the beach past the town of Funduklee, as well as along the southern part of the main river plain through the village of Novo Orekhovo. There is a limited amount of cultivated land in this area, but most of

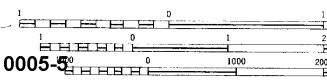
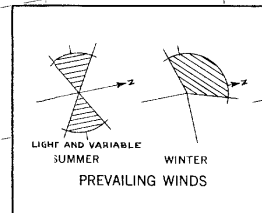
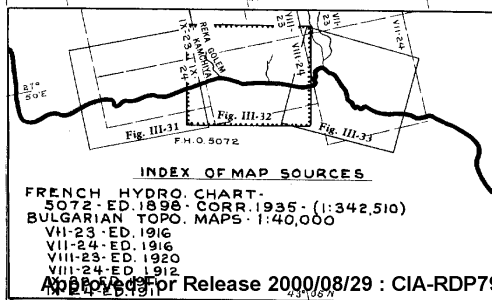








38
Sand and pebble beach 6 miles long, maximum width about 600 feet, but generally narrower. Beach interrupted by bluffs near northern end; beach may extend north of river mouth. Fore-shore firm; beach slopes gentle to moderate.



~~Confidential~~

the country is forested, including the river plain of Reka Golema Kamchiya.

(39) *Varna—A.* (Figure III - 33.) Reliability fair.

(a) *Location and extent.* Beginning at the southern breakwater of Varna harbor is a wide, sand beach extending south-southeastward for $1\frac{1}{4}$ miles across the westernmost part of Gulf of Varna. Its ends are at latitude $43^{\circ} 10' 20''$ N., longitude $27^{\circ} 55' 10''$ E. and latitude $43^{\circ} 11' 15''$ N., longitude $27^{\circ} 54' 30''$ E. The lighthouse at Galata, one mile east of the southern end of the beach, and the light at the end of the principal breakwater of Varna harbor constitute landmarks aiding in the approach to the beach. (Illustrations III - 54 and III - 55.)

(b) *Nearshore.* The bottom slopes moderately up to the beach. The 30-foot depth line lies approximately $\frac{3}{4}$ mile to a mile off the shore, except towards the north where the harbor entrance is kept dredged. The 18-foot depth line is about $\frac{1}{4}$ mile from the shore. The bottom material is sand, somewhat muddy at greater depths, but becoming purer sand as the beach is approached. The outer harbor mole, which extends southward from the town of Varna, protects the northern end of the beach and may be considered an off-shore hazard in the approach; it lies nearly a mile from the beach. A hydrographic chart of the Varna region is reproduced as Figure III - 34. The southern end of the beach for about $\frac{1}{8}$ mile is lined with rocks close to the shore, in the vicinity of the mouth of a small stream. The prevailing winds in this region are east and west in summer, and from the northwest quadrant in winter. Cape Galata (Nos Galata, bearing a lighthouse called "Far Galata" on the map) protects the beach from southeast storms, and the harbor breakwater offers considerable protection from northeast storms to the north

end of the beach. Wave action is seldom severe here. Offshore currents, seaward of the breakwater, are generally from north to south; closer to shore they are probably weak and variable. There are no tides. Water temperature varies from an average of about 3° C. in February to 23° C. in August. During February the air temperature varies from about -8° C. to 13° C., while during August it varies from 12° C. to 35° C.

(c) *Landing place.* The beach is $1\frac{1}{4}$ miles long and 250 to 3000 feet wide. It is terminated at the north by a canal connecting Lake Devna (Devnsko Yezero) with the sea, and at the south by the steep cliffs of Cape (Nos) Galata. A small stream crosses the beach about 800 feet from its southern end. The beach is moderately fine sand; the foreshore is firm, with a moderate to gentle slope. The backshore is soft, and has a gentle slope, rising at the back to dunes. The surf is generally moderate, covering a wide belt. When waves are running there are many lines of low breakers. Shore drift is very slight, but southward. The mouth of the canal at the north end of the beach is protected by a jetty about 1,000 feet long extending east-southeastward, making a slightly acute angle with the beach. At its root are several buildings, probably commercial. At the south end of the beach is a landing jetty at the foot of a quarantine station (adjacent to "Brewery" on map). A spring is situated near the head of the jetty. Illustration III - 73 shows the quarantine station and the beach fronting it.

(d) *Terrain inland and on flanks of beach.* Immediately back of most of the beach is a wide belt of dunes and wind-blown sand. This belt is low and in places as much as $\frac{1}{2}$ mile wide. At the northern end the sand belt narrows and is backed by low, marshy land bordering the canal from Lake Devna. To the southwest and south the sandy plain gives way to steep slopes which directly back the beach at its southern



Illustration III - 73. Varna.
Looking southwest at the quarantine station and beach south of the harbor.

end, except for a very small flood plain at the mouth of a little stream. There are two more springs besides the one at the quarantine station situated in this region. They are both about 3,000 feet inland, one a little north, the other a little south of the center of the beach. The first is close beside a highway, the second some 150 feet up the side of a hill. The highway, running from the southwest, comes within about 500 feet of the north end of the beach. It crosses the canal by a bridge, and runs into Varna $\frac{1}{2}$ mile distant. A road from the quarantine station at the south end of the beach runs northwest and north, joining the highway one mile south of Varna. In general in this area the mountains are wooded, the lowlands grassy. Lower slopes or plains between the hills and the marshes are extensively cultivated and are laid out in fields and orchards. There is considerable industrial activity in this area; several factories are located not far from the shore.

(40) *Varna—B.* (Figure III - 33.) Reliability good.

(a) *Location and extent.* Fronting Varna between the harbor mole and the cemetery northwest of the town is a broad beach about one mile in total length, of which more than half constitutes a sandy bathing beach about 200 feet wide. It extends from latitude $43^{\circ} 11' 50''$ N., longitude $27^{\circ} 55' 10''$ E. to latitude $43^{\circ} 12' 25''$ N., longitude $27^{\circ} 56' 00''$ E. The buildings of the town constitute landmarks, of which the Bulgarian Cathedral with six cupolas is the most conspicuous. Figure III - 34 is a plan of the town.

(b) *Nearshore.* The bottom slope of the sea off this beach is moderate. The 30-foot depth line lies about 2,000 feet from the shore, the 18-foot line about halfway between. Depths of six feet are found 150 feet from the shore or closer south of the naval academy, but north of it, the six-foot depth line, though irregular, lies generally more than 200 feet from the shore. The bottom is composed of rock with a thin layer of sand and loose rocks scattered upon it. The area close to the root of the harbor breakwater is the most free from rock hazards. Anchorage is good in the southern part of the off-shore region eastward of the harbor breakwater. A chart of

the Varna region is reproduced as Figure III - 14. The prevailing winds in this area are from the east and west in summer and from the northwest quadrant in winter. Storms come from northeast and southeast. Waves approach from the east and southeast but start to break a considerable distance from the shore. Currents are generally southeastward along the shore. There is no tide. The temperature of the water in the bay varies from an average of about 3° C. in February to 23° C. in August. During February the air temperature varies from about -8° C. to 13° C., while during August it varies from 12° C. to 35° C.

(c) *Landing place.* The total length of the beach is about one mile, but it is interrupted a short distance from its northern end by a slight, but broad promontory. The southern part, something more than $\frac{1}{2}$ mile long, is a popular bathing beach, while the northernmost portion, about $\frac{1}{4}$ mile long, is unimproved. Two small streams, 1,000 feet apart, empty across the bathing beach section, one at each end of the main bathhouse structure. The beach is 200 feet wide, composed of pure, very fine sand, with some pebbles especially in a narrow belt between the foreshore and backshore. Photographs (Illustrations III - 74, III - 75 and III - 76) show a foreshore about ten feet wide with a slope of one on five, but with a slight, abrupt rise to the backshore of which the first 50 feet from the seaward margin has a slope of about one on 15, gradually flattening to an imperceptible slope at its landward margin, which is marked by a cliff. The back part of the beach has a cover of sparse grass. The foreshore surface is firm, the backshore somewhat soft. The surf (Illustrations III - 77, III - 78 and III - 79) breaks over a wide belt, with several lines of breakers. Shore drift is generally south-eastward. There are numerous structures on the beach, whose plan is shown on the accompanying plan of the city (Figure III - 34). The central part of the backshore is occupied by an extensive bathhouse. (Illustrations III - 56 and III - 80.) Three piers, shown in the plan of Figure III - 34, and the photographs (Illustrations III - 76, III - 80 and III - 81) extend from the shore near the marine academy, $\frac{1}{4}$ mile from the breakwater, from the main part of the bathhouse



Illustration III - 74. Varna.

Looking south at the bathing beach. Main harbor breakwater in left background. Old photograph, taken prior to erection of bathhouses and pavilions.



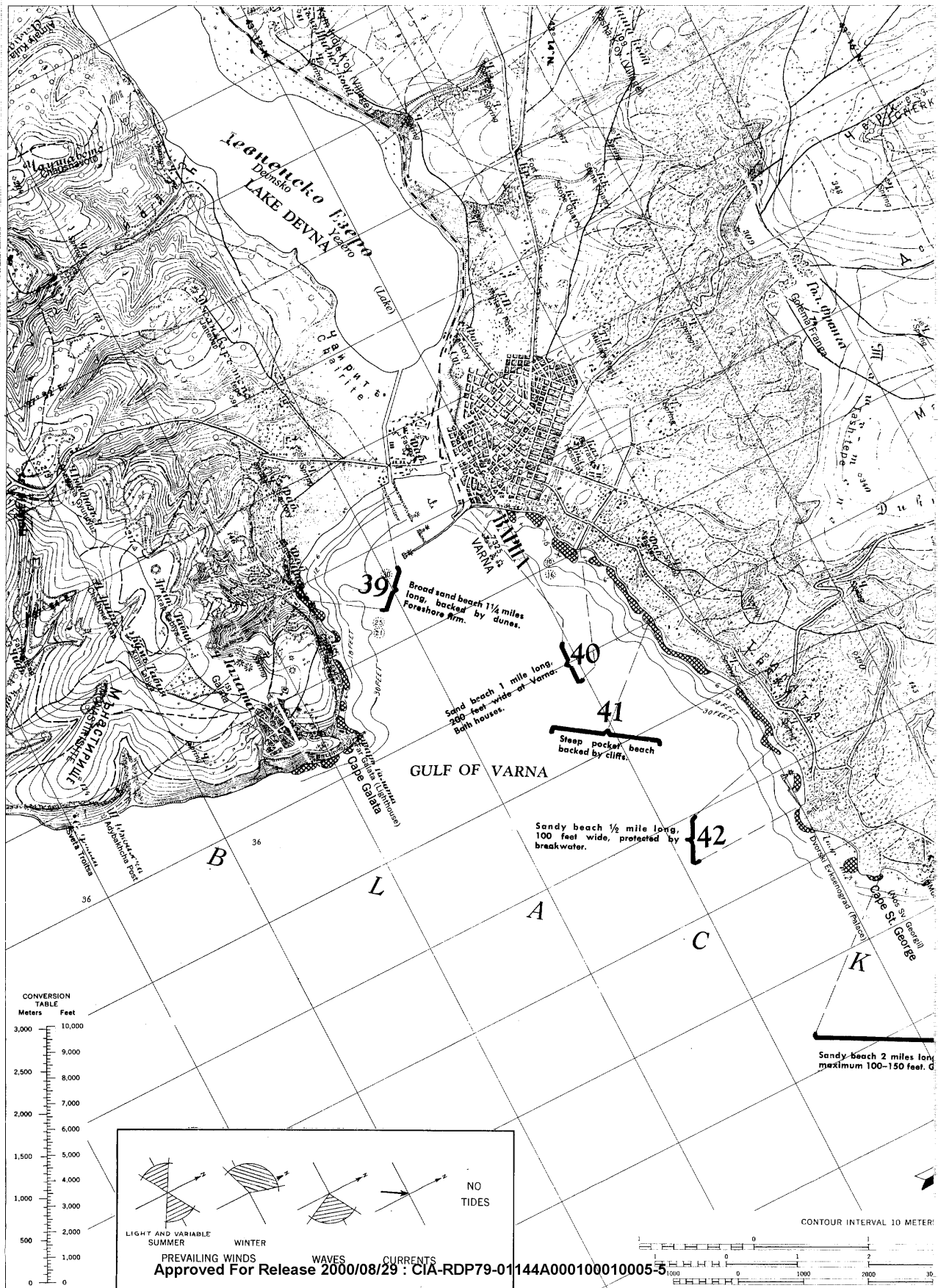




Illustration III - 75. Varna.

Looking north at the bathing beach. Main pier in right background. Photograph shows the belt of pebbles between the backshore and the narrower, steeper foreshore. Before 1939.

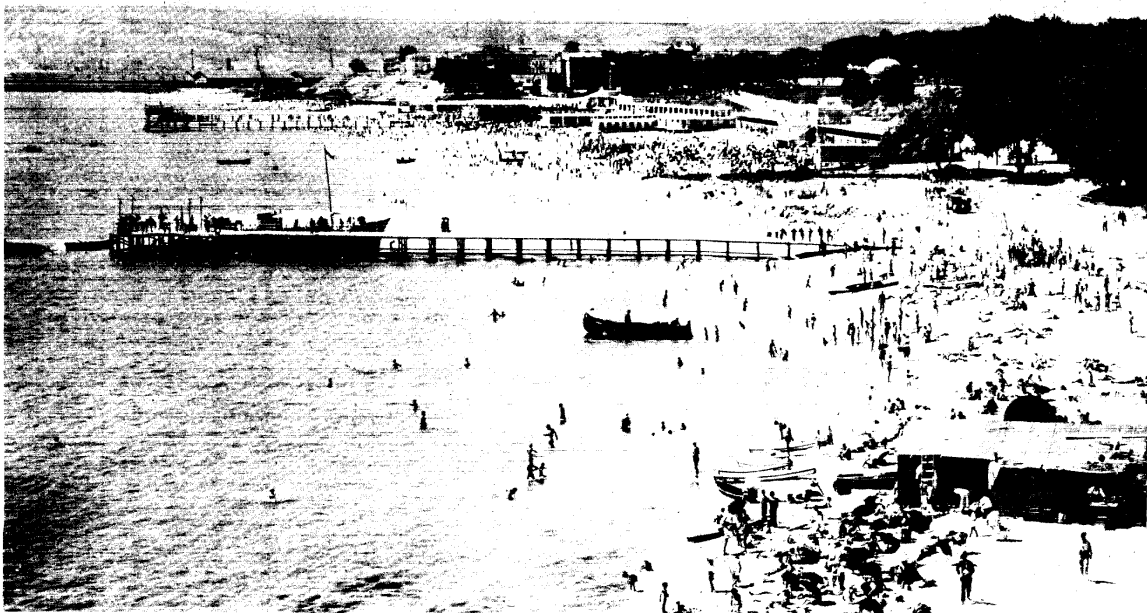
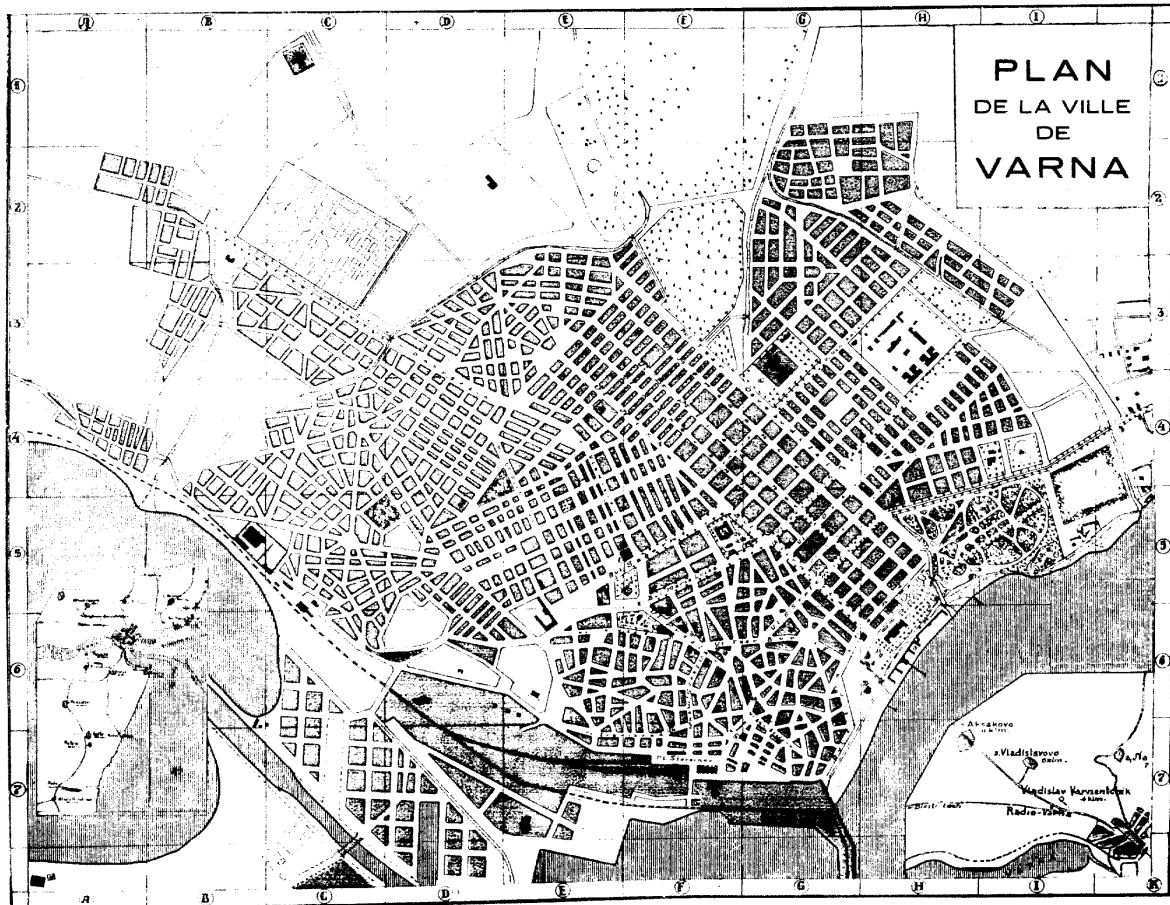


Illustration III - 76. Varna.

Looking south over the bathing beach. Pier in foreground is the one indicated in Illustration III - 78. Before 1939.

FIGURE III - 34



BULGARIA. Plan of the city of Varna. Structures of the beach and resort area fronting the town are shown in the lower left-hand corner. Note the three piers mentioned in the text. Photocopy from "La Bulgarie Touristique" by Georges Kanozirsky.



Illustration III - 77. Varna.

Surf near the main bathhouse. Looking north. Before 1936.

1,800 feet from the breakwater, and at the foot of the marine gardens $\frac{1}{2}$ mile from the breakwater. A detached breakwater is reported off the beach but information concerning it is not available.

(d) *Terrain inland and on flanks of beach.* The beach is backed directly by a bluff upon which the town of Varna lies on a plateau. This bluff, or cliff, is lowest at the south, rising to

30 feet and more at the north end of the beach. Between the top of the cliff and the town, to the north, are parks and public gardens and back of the northernmost part of the beach, a cemetery. Beyond, to the north, slopes rise steeply to a high plateau (Illustration III - 82). The exact position of exits from the beach is not known but there are undoubtedly numerous ones for the use of bathers. At the top of the bluff the city streets of Varna provide access to highways running northward to Balçik, 35 miles distant, and southward to Burgaz, approximately 110 miles away. At the breakwater is the terminus of a railway providing transportation to Balçik and to the interior. Vegetation near the beaches consists chiefly of the cultivated trees and grasses of the city parks. The low, rounded hills near Varna are covered with vineyards.

(41) *Varna—C.* (Figure III - 33.) Reliability fair.

(a) *Location and extent.* Nearly two miles from the Varna harbor breakwater is a small pocket beach at the foot of a large villa on a high cliff. It is located at about latitude $43^{\circ} 12' 40''$ N., longitude $27^{\circ} 57' 00''$ E.

(b) *Nearshore.* The bottom slope is moderate, the 30-foot depth line lying about $\frac{1}{4}$ mile from the shore. Depths of six feet lie 500 feet offshore. The bottom is rock thinly



Illustration III - 78. Varna.

Surf on the beach south of pier indicated in Illustration III - 76.

veneered with sand which becomes thicker close to the shore. Scattered rocks constitute abundant hazards. This area is shown on the hydrographic chart, H.O. 4196 and Figure III - 14. The beach is sheltered by the surrounding cliffs from the prevailing winds, but is open to southeast storms. Waves come from the south and are probably heavy during southeast storms. Currents are probably slight and generally eastward. There is no tide. Water level is raised during southeast storms. Water temperature varies from an average of about 3° C. in February to 23° C. in August. During February the air temperature varies from about -8° C. to 13° C., while during August it varies from 12° C. to 35° C.

(c) *Landing place.* The beach is probably no more than 400 feet long and 100 feet wide. It is composed of sand and gravel with pebbles, and has a firm surface with a steep fore-shore slope and moderate backshore slope. The surf is not generally heavy but there is more than a single line of breakers. Shore drift is westward. A spring is located at the western end of the beach. No structures are known on it.

(d) *Terrain inland and on flanks of beach.* The cliffs completely backing the beach are about 100 feet high. Upon them is a plain about 1,600 feet wide, backed by steep mountain slopes. No exits from the beach are known, but there is undoubtedly a route to the villa above it. A highway lies 1,000 feet back of the cliff by which Varna, less than two miles westward, may be reached. Vegetation consists of fields and orchards.

(42) *Evksinograd (Euksenograd).* (Figure III - 33.) Reliability good.

(a) *Location and extent.* This sandy beach lies just inside the northern part of the Gulf of Varna, its center at latitude 43° 13' 10" N., longitude 27° 59' 05" E. It is a little more than ½ mile long, narrow, and protected by a breakwater. It may be recognized by the buildings of the King's summer palace, with its conspicuous tower, above it and by the lighthouse on the end of the breakwater (Illustrations III - 83 and III - 84).

(b) *Nearshore.* The slope of the bottom is moderate, the 30-foot depth line lying about 2,000 feet offshore, the 18-foot line 1,000 feet, and the 6-foot line about 400 feet from the shore. The bottom material is sand and mud, changing to sand near shore. There are a great many rocks scattered about within 500 feet of the shore. The cape eastward of the beach protects it from east and northeast winds to some extent, and the breakwater which projects westward about 250 feet from the foot of the cape shelters the beach from high waves during southeast storms. (Illustrations III - 83 and III - 84.) Waves strike the beach generally from south to southwestward. Probably little, if any, current is found in this small harbor. There are no tides. Water level may be raised somewhat during southeast storms. Water temperature varies from an average of about 3° C. in February to 23° C. in August. During February the air temperature varies from about -8° C. to 13° C., while during August it varies from 12° C. to 35° C.



Illustration III - 79. Varna.
Looking northeastward at the wide surf belt on the north end of the beach.



Illustration III - 80. Varna.
Looking southeast across the Bay of Varna from the cliff behind the bathing beach. Cape Galata shows in the left background. Harbor breakwater at right center.

~~Confidential~~

OCEANOGRAPHY, COASTAL HYDROGRAPHY, COASTS, LANDING PLACES

Page III - 75

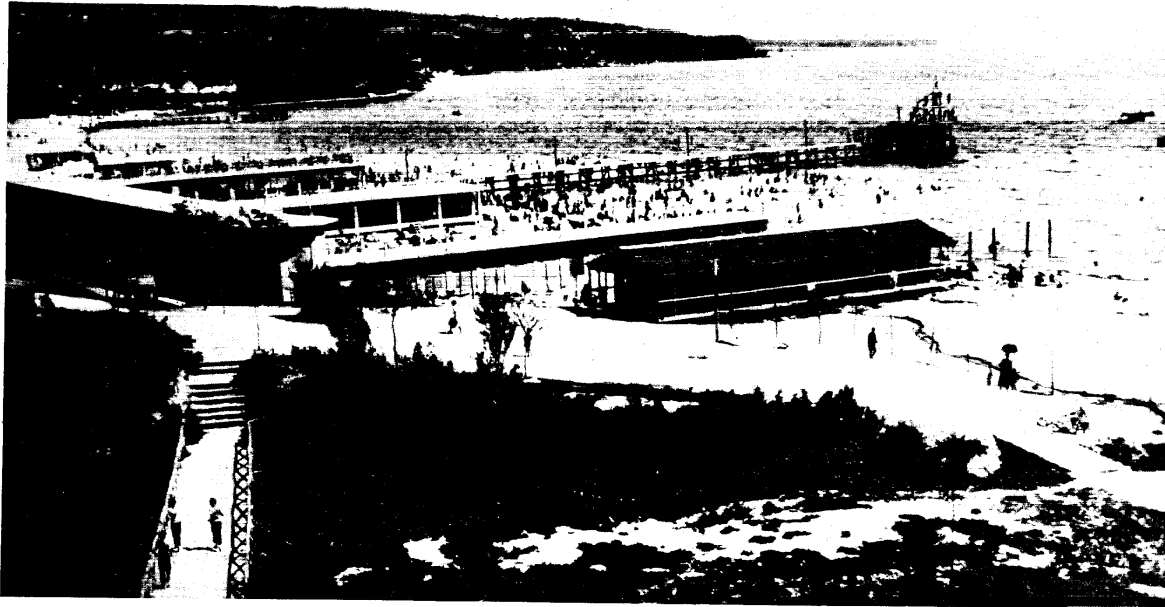


Illustration III - 81. Varna.

Looking northeast across the Bay of Varna from the cliff behind the bathing beach. A stream in foreground. Cape Sveti Dmitri in right far distance.

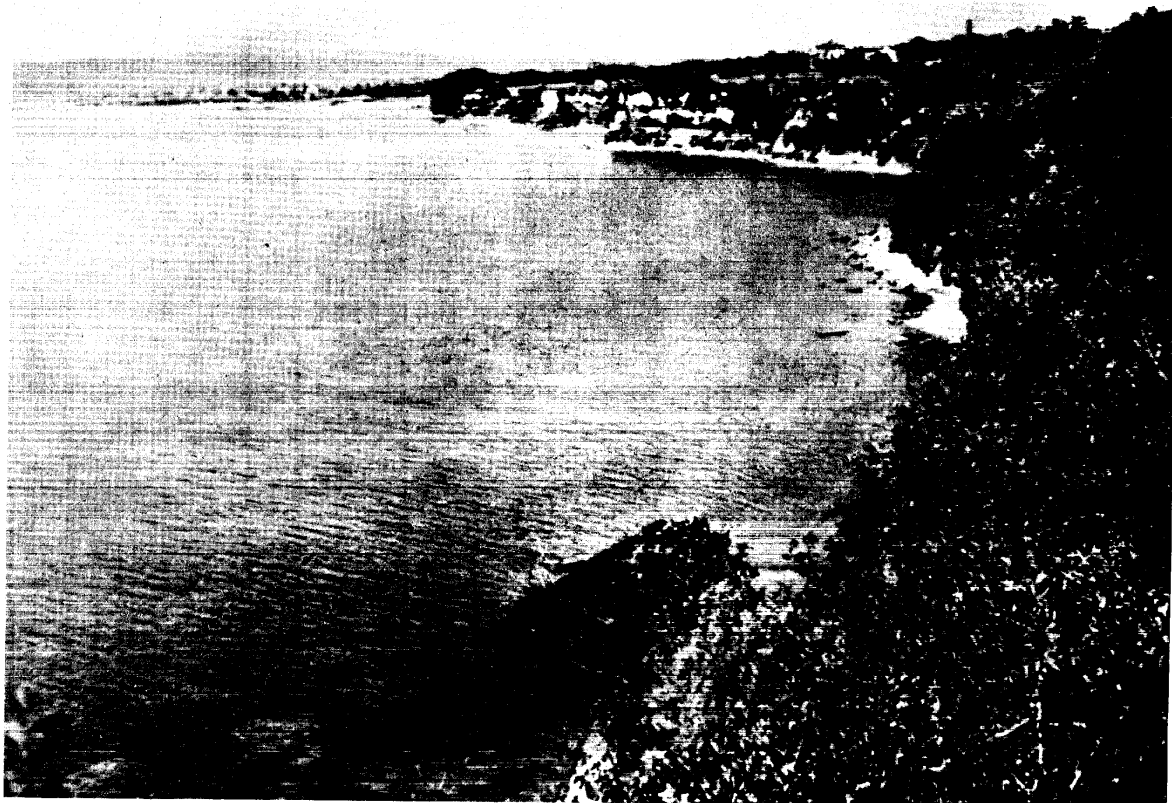


Illustration III - 82. Varna.

Looking south from the cliffs northeast of Varna.



Illustration III - 83. Evksinograd.

Looking east at the beach and harbor breakwater. The Palace turret shows in the left background.



Illustration III - 84. Evksinograd.

The lighthouse on the end of the harbor breakwater.

(c) *Landing place.* The beach is more than $\frac{1}{2}$ mile long and it lies along a gently curving embayment in the shore so that its western part extends in an east-west direction, while its eastern end swings southward. It is about 100 to 150 feet wide, the westernmost part being wider than the eastern. It is com-

posed of sand and gravel, with some pebbles. The foreshore is firm with a moderate slope, while the backshore is somewhat softer with an increasingly gentle slope. A small stream crosses the beach in the northeast corner of the bay. The surf is light, but when waves are running it covers a belt of considerable width and the waves break in several lines. Shore drift is slight but generally westward. A short mole is located in the northeast corner of the little harbor, sheltered by the breakwater. No other structures are known.

(d) *Terrain inland and on flanks of beach.* Back of the western part of the beach the terrain rises northward in steep slopes, with elevations of over 500 feet, less than $\frac{1}{2}$ mile from the beach. Northeastward a low, gentle slope rises to the plain upon which is built the King's summer palace. Apparently several roads run to or practically to the beach here so that exit should present no difficulty. From Evksinograd the highway running west-southwestward to Varna, a little more than three miles distant, or northeastward to Balci, about 20 miles distant, is easily reached. Vegetation in this area is light with much cultivated area.

(43) *Sveti Konstantin (Constantine).* (Figure III - 33.) Reliability fair.

(a) *Location and extent.* A beach, narrow in its southern part but fairly wide to the north, extends from the headland Cape St. George (Nos Sveti Georgii) northward to Tsaritsa Eleanora Sanatorium, a distance of about two miles. It begins at latitude $43^{\circ} 13' 20''$ N., longitude $28^{\circ} 00' 25''$ E. and extends to latitude $43^{\circ} 14' 40''$ N., longitude $28^{\circ} 01' 20''$ E.

(b) *Nearshore.* The bottom slope is fairly steep. The 30-foot depth line lies about $\frac{1}{4}$ mile from the shore, somewhat less at the southern end of the area, and nearly $\frac{1}{2}$ mile away off the sanatorium. In the northern part of the area the approach is apparently clear of rocks and reefs, but in the southern part scattered rocks abound, particularly near the

shore. In summer the winds are variable, prevailing from the east or the west; in winter they come chiefly from the northwestern quadrant and have little effect upon this area. Waves come from the east or east-southeast and are strong during southeast storms, when the water level is somewhat raised. Offshore currents have a general northeasterly direction. There are no tides.

(c) *Landing place.* Although the beach extends for a distance of two miles, it is of variable quality. The southern half follows an irregular, rocky shoreline; it widens at stream mouths to 100 or 150 feet, and is interrupted in several places by rocky headlands. The northern part, however, is broader and less interrupted. The southern part is composed of sand and gravel, the northern part of sand or sand and pebbles. Slopes are generally steeper in the southern part, although the backshore is more gentle than the foreshore in both areas. The foreshore is firm, the backshore somewhat softer, especially to the north. The width of the surf belt is limited at the southern end of the area, gradually spreading out to the north where the waves break in several lines of breakers. Shore drift is slight but generally southward. No structures are known on the beaches.

(d) *Terrain inland and on flanks of beach.* A bluff backs the southern part of the beach, from which slopes rise inland, somewhat gently at first. The slopes rising from the northern part of the shore are steeper. Slopes are generally forested. In the vicinity of the village of Sveti Konstantin about $\frac{1}{2}$ mile north of Cape St. George, at the mouth of a small stream, the gentle slopes are laid out in fields. Northward of the cultivated

area, along the stream valley, the natural vegetation is low and brushy. A highway runs from the sanatorium (Illustration III - 85) south and southeastward to Varna about eight miles distant. It lies less than 500 feet back of the beach near the sanatorium but is more than $\frac{1}{4}$ mile inland near Sveti Konstantin, and may be difficult to attain from the beach with vehicles. A highway leads to it from the town, and a trail leads to it from the southern end of the beach. A road runs between this trail and the town at a distance of a few hundred feet from the beach.

(44) *Bel Monastir Post.* (Figure III - 35.) Reliability fair.

(a) *Location and extent.* North of Bel Monastir Post about $\frac{1}{4}$ mile is a beach beginning at latitude $43^{\circ} 16' 40''$ N., longitude $28^{\circ} 02' 30''$ E., and extending to latitude $43^{\circ} 17' 45''$ N., longitude $28^{\circ} 02' 50''$ E. This sandy beach is about $1\frac{1}{4}$ miles long, in places 300 feet wide. The buildings of the monastery probably are a landmark in an otherwise little inhabited region.

(b) *Nearshore.* The sea bottom has a gentle slope, with the 30-foot depth line lying a mile from the shore. No hazards are known in the approach to the beach. Winds are prevailing east or west in summer, and northwest in winter. Southeast storms may be violent in winter. Waves approach from the east, but the waves are not large near the shore, breaking some distance from it. Offshore currents are generally southward. There are no tides.

(c) *Landing place.* The beach lies almost in a straight line uninterrupted throughout its length, and of fairly uniform width, 250 to 300 feet. It is composed of sand and pebbles.



Illustration III - 85. Sveti Konstantin.
Looking northwest at the beach and the Tsaritsa Eleanora Sanatorium.

The foreshore is firm and has a moderate slope. The backshore is soft and has a gentle slope. When waves are running the surf covers a wide band with many lines of low breakers. Shore drift is slight and southward. No structures are known on this beach, which is comparatively isolated.

(d) *Terrain inland and on flanks of beach.* Steep slopes rise back of the beach, commanding it at every point. They are completely forested. Streams are small, few, and steep. Several trails run among the hills. One of these, about 500 feet back of the beach, provides an exit to the southward to the little village of Kestrich about four miles distant in a straight line, where there is a road. Another runs northward to Yekrene some $3\frac{1}{2}$ miles distant, from which there are likewise roads running inland and northward.

(45) *Yekrene.* (Figure III - 35.) Reliability fair.

(a) *Location and extent.* Yekrene is a small village built on the hill slopes about $\frac{3}{4}$ mile from the shore. A broad sand beach begins slightly south of the town and extends north-northwestward for $3\frac{1}{2}$ miles, bordering Batova Bay (Zaliv Batva). Its southern terminus is about latitude $43^{\circ} 19' 50''$ N, longitude $28^{\circ} 04' 00''$ E and its northern about latitude $43^{\circ} 22' 40''$ N, longitude $28^{\circ} 05' 40''$ E.

(b) *Nearshore.* The slope of the sea bottom is moderate, the 30-foot depth line lying something more than $\frac{1}{2}$ mile from the shore. The bottom is composed of tough clay, changing to sand at depths less than 30 feet. The approach to the beach is free from rocks or shoals. Winds are prevailing east or west in summer, and from the northwest quarter in winter. The northwesterly winds sometimes sweep down across the plain backing the beach with great violence. Waves approach generally from the east and southeast, and southeast storms may raise a considerable swell. Offshore currents are generally northeastward. There are no tides.

(c) *Landing place.* The beach, which borders a low swampy plain, is composed of firm sand, and is $3\frac{1}{2}$ miles long and about 300 feet wide. The foreshore has a moderate slope, while the backshore is essentially flat and soft. The beach extends in almost a straight line. There is apparently only one small stream crossing it $\frac{3}{4}$ mile from its southern end. However, the Batova (Batva) river flows into the swamp back of the central part of the beach, and in season a channel, probably shifting, discharges across the beach from the swamp. Otherwise the beach is uninterrupted. The surf, when waves are running, is moderate, waves breaking in several lines of breakers. Shore drift is slight, and probably generally northward. There are no structures on the beach.

(d) *Terrain inland and on flanks of beach.* The broad plain back of the beach is the lower part of the flood plain of the Batova river, and it extends upstream about five miles. It is thickly wooded, and in places cultivated. Steep slopes rise northeast and southwest of it to a plateau at elevations of more than 800 feet. A trail runs along the beach from about its center northward, then climbs a 130-foot bluff to a road leading into Balcic about $2\frac{1}{2}$ miles distant in a straight line. No obvious exits are shown from the south end of the beach, but the village of Yekrene is only $\frac{3}{4}$ mile inland and the terrain between it and the beach is apparently solid and not marshy.

(46) *Balcic (Balchik).* (Figures III - 35 and III - 36.) Reliability fair.

(a) *Location and extent.* The beach faces south and fronts the town of Balcic, which lies at the head of a small, slightly

indented bay. It is narrow, about $1\frac{3}{4}$ miles long, and composed of gravel and pebbles. It extends from latitude $43^{\circ} 24' 10''$ N, longitude $28^{\circ} 08' 45''$ E, to latitude $43^{\circ} 24' 00''$ N, longitude $28^{\circ} 10' 20''$ E. (Illustration III - 86).

(b) *Nearshore.* The bottom slope is moderate; the 30-foot depth line lies a little more than $\frac{1}{2}$ mile off the western part of the beach, a little less than that distance off the eastern part. The bottom is composed of tough clay. There are apparently no rocks or rock shoals in the approach to the beach, although rocks lie just beyond the beach limits marked on the accompanying map. There is good anchorage in the



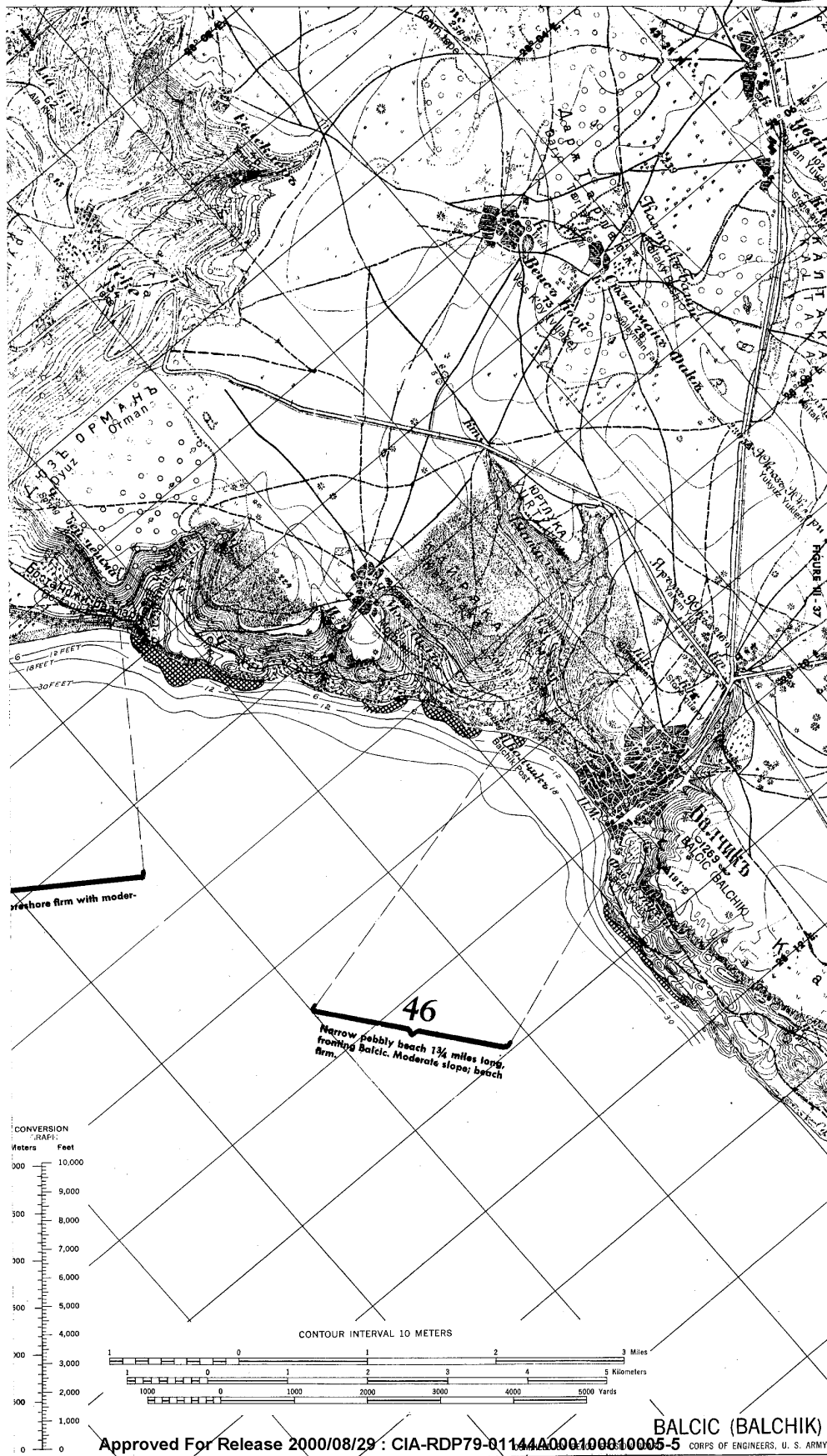
Illustration III - 86. Balcic.

Looking eastward over the Royal Palace toward the town. Pier in distance shows at top of Illustration III - 90. Before 1938.

bay $\frac{3}{4}$ mile from the shore in five to six fathoms, with protection from northerly winds in winter months and from all bad weather. Although the bay is open to the south, south-east storms do not blow into it with severity. Wave approach is from the south and southeast; heavy seas start to break some distance out from the shore. There are no tides. Water level is raised by southeast storms (Figure III - 36).

(c) *Landing place.* The beach (Illustration III - 89) is composed of gravel, pebbles, and a high proportion of coarser materials. The "usable" part of it is about $1\frac{3}{4}$ miles long; beyond the limits shown on the map it extends at the foot of steep cliffs and is exceedingly narrow. It is generally not more than 40 or 50 feet wide. The foreshore is fairly steep, the backshore of moderate slope. Both are firm. At least four small streams flow across the beach. Springs are located near the head of the ravine close eastward of Balcic. (Illustration III - 90). Water is also available from a stream about one mile to the west of the ravine, which flows from a spring located near the head of the ravine. The surf is heavy, with waves breaking over a broad belt of three lines of breakers, as shown in Illustrations III - 86 and III - 88. In Illustration III - 90 are shown two piers projecting from the shore. One of these, probably the western or uppermost in the photograph, is reported to have depths of eight feet at its outer end.

(d) *Terrain inland and on flanks of beach.* Hills of varying height back the beach (Illustrations III - 87, III - 88 and III - 89), rising a short distance inland to a cliff bordering a plateau with elevations higher than 600 feet. The cliffs are broken by steep ravines. The slopes are wooded, the plateau top grassy. City streets offer direct exits from the beach. A highway runs northward up the side of a ravine out of town, connecting



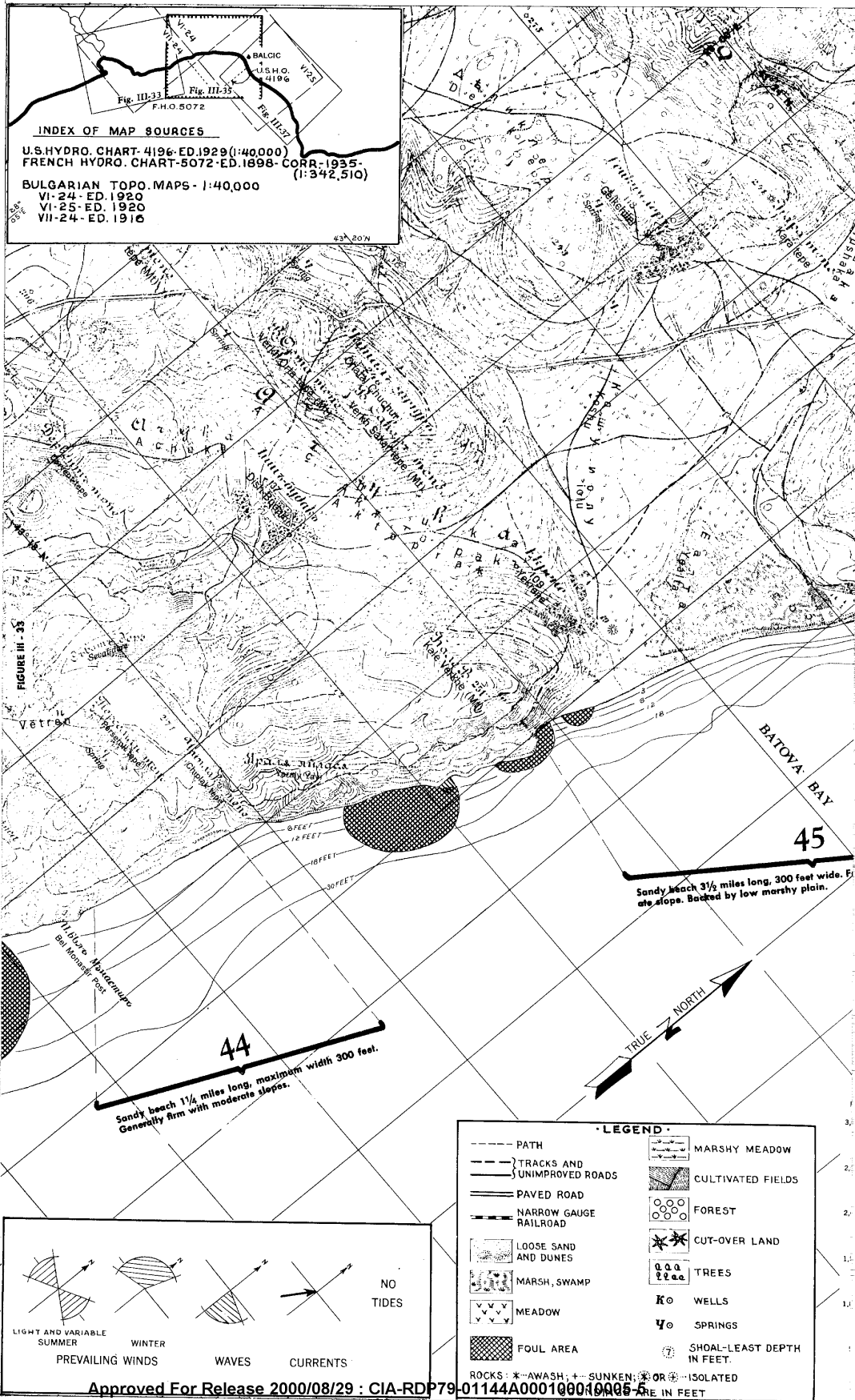
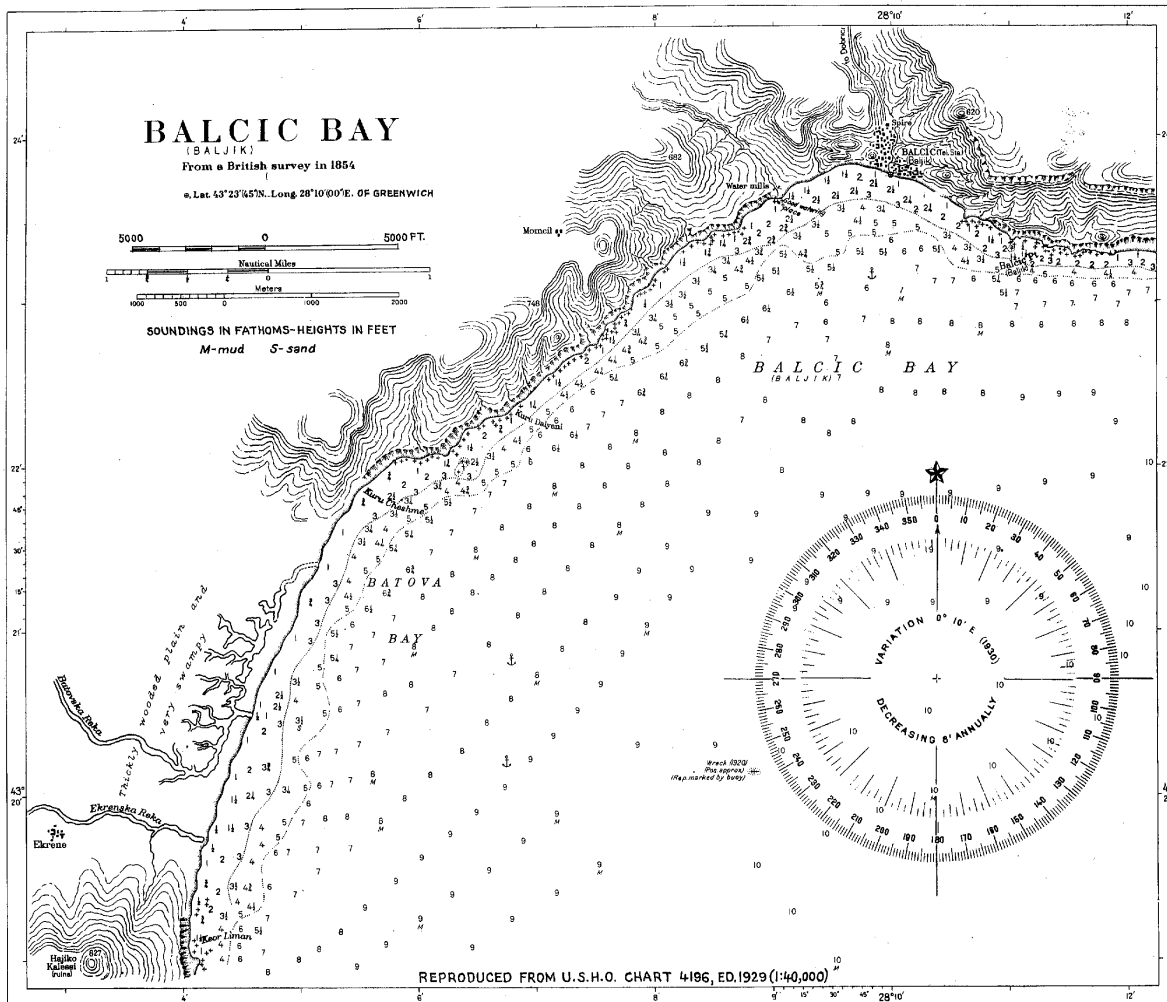


FIGURE III - 36



BULGARIA. Balcic Bay.

with a network of highways running in various directions. According to one map source there is a railroad terminal at Balcic, with a line running inland to the north.

(47) *Cavarna (Kavarna)*. (Figures III - 37 and III - 38.) Reliability fair.

(a) *Location and extent*. A pebble beach about 1,500 feet long and very narrow lies at the foot of the broad and deep ravine leading from the town of Cavarna southeastward to the shore. Its center is about latitude 43° 24' 50" N, longitude 28° 21' 20" E. A triangular hillock, lying between the two branches of the ravine, south of Cavarna, is easy to distinguish from all directions. (Illustration III - 91.)

(b) *Nearshore*. Little information is available regarding depths off this shore. They are, however, considerable. The 30-foot depth line is probably within ¼ mile of the beach. There may be rock hazards near the beach, but not directly in the approach. The bottom material is mud. The anchorage

is about 1¼ miles offshore in about eight fathoms. High cliffs surrounding the beach shelter it fairly well from winds



Illustration III - 87. Balcic.

Looking west over the town and environs. Before 1928.



Illustration III - 88. Balcic.
Looking east from behind the town. Before 1936.



Illustration III - 89. Balcic.
Small pocket beach slightly east of the town.

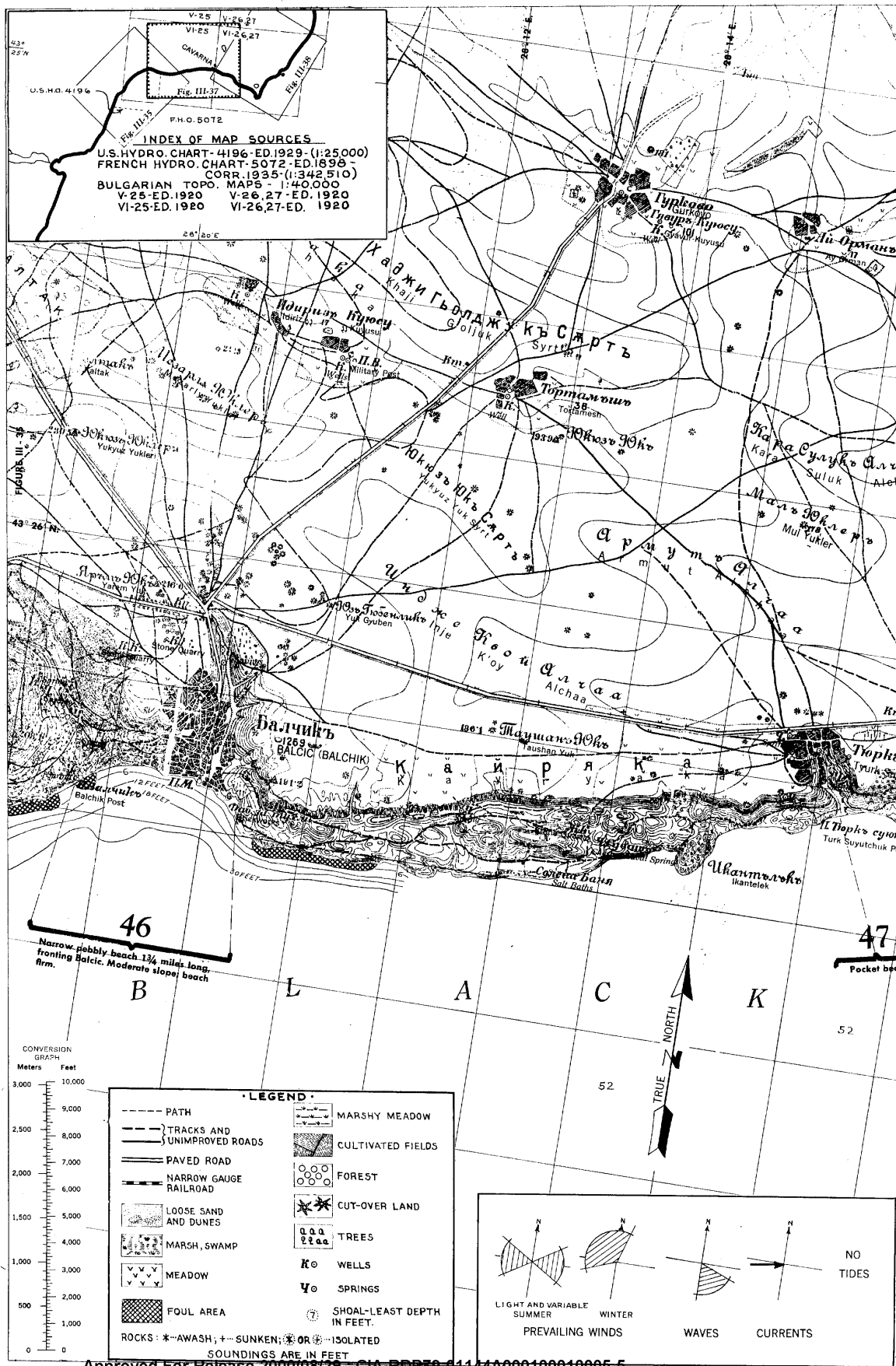
FIGURE III-37

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Illustration III - 90. Balcic.

Looking southwestward over the town and bay. Two piers show in left distance.

from all directions. Waves approach from the south and southeast, and are heavy during southeast storms. Offshore currents are generally eastward. There are no tides.

(c) *Landing place.* The beach (Illustration III - 92) is about 1,500 feet long, not more than 50 or 60 feet wide. It is composed of coarse gravel and pebbles, and has a firm surface. The foreshore slope is steep, and the backshore has a moderate slope. The surf covers a moderately wide belt; the accompanying photograph (Illustration III - 93) shows three lines of breakers. Two small piers are shown in Illustrations III - 92 and III - 93; one of these is reported to have a depth of eight feet at its end. Water is available from springs located in the ravine between the beach and Cavarna; other springs and wells are numerous in this region. Tiny pocket beaches are located at the mouths of ravines both east and west of Cavarna. Two of these are represented in Illustrations III - 91 and III - 94. The first shows the beach at the mouth of the stream Tyurk-Suyutchuk, four miles west of Cavarna, lying about in the center of the photograph with a single breaker line at the shore. The second is a close view of the beach rubble at the mouth of a ravine two miles east of Cavarna, showing seaweed bordering the beach.

(d) *Terrain inland and on flanks of beach.* The main ravine back of the Cavarna beach trends northwestward to Cavarna, and a branch of it trends in a more westerly direction almost parallel to the shore. The hill between the branches is nearly

450 feet high. The cliffs at each end of the beach are not much lower. There are several buildings on the small flood plain area immediately back of the beach (Illustration III - 95), and a road leads from them up the ravine to Cavarna, forming a convenient exit from the beach. Cavarna is about nine miles east of Balcic. The pocket beach west of Cavarna has a trail lying a short distance back of it, and the highway lies up the ravine at the town of Tyurk-Suyutchuk $\frac{3}{4}$ mile from the shore. From the pocket beach east of Cavarna a trail leads up its east cliff to the village of Gyavur-Suyutchuk.

(48) *Bol-Ata Dere.* (Figure III - 38.) Reliability good.

A small exposed pocket beach is located at the mouth of the Bol-Ata Dere stream $1\frac{1}{2}$ miles north of Cape Caliacra. Probably exit is possible by walking up the ravine, but the route is continually commanded by steep heights, as shown in Illustration III - 96. The latitude of the center of the beach is $43^{\circ} 22' 55''$ N, its longitude $28^{\circ} 28' 25''$ E.

(49) *Syurtyu-K'oy.* (Figure III - 38.) Reliability good.

(a) *Location and extent.* Syurtyu-K'oy lies atop a cliff about 230 feet high. At the foot of the cliff is a completely isolated area about $2\frac{3}{4}$ miles long consisting of broken fragments of the cliff interspersed with beach deposits. Its limits are at latitude $43^{\circ} 24' 40''$ N, longitude $28^{\circ} 29' 50''$ E. and at latitude $43^{\circ} 25' 55''$ N, longitude $28^{\circ} 32' 30''$ E.

(b) *Nearshore.* The 30-foot depth line is between $\frac{1}{2}$ and $\frac{1}{4}$ mile from shore; it lies closer to the northern part of the shore.



Illustration III - 91. Cavarna.
Seaweed bordered shore of tiny pocket beach east of town. The town shows in right distance. Before 1928.



Illustration III - 94. Cavarna.
Looking east on the shore west of the town. The peninsula in the background is Kalkan-tepe. Before 1928.



Illustration III - 92. Cavarna.
Long view from the east of the piers and beach before the town. Before 1928.



Illustration III - 95. Cavarna.
Looking southeast over the bay, the town and the valley leading to north, left middle distance. Before 1928.

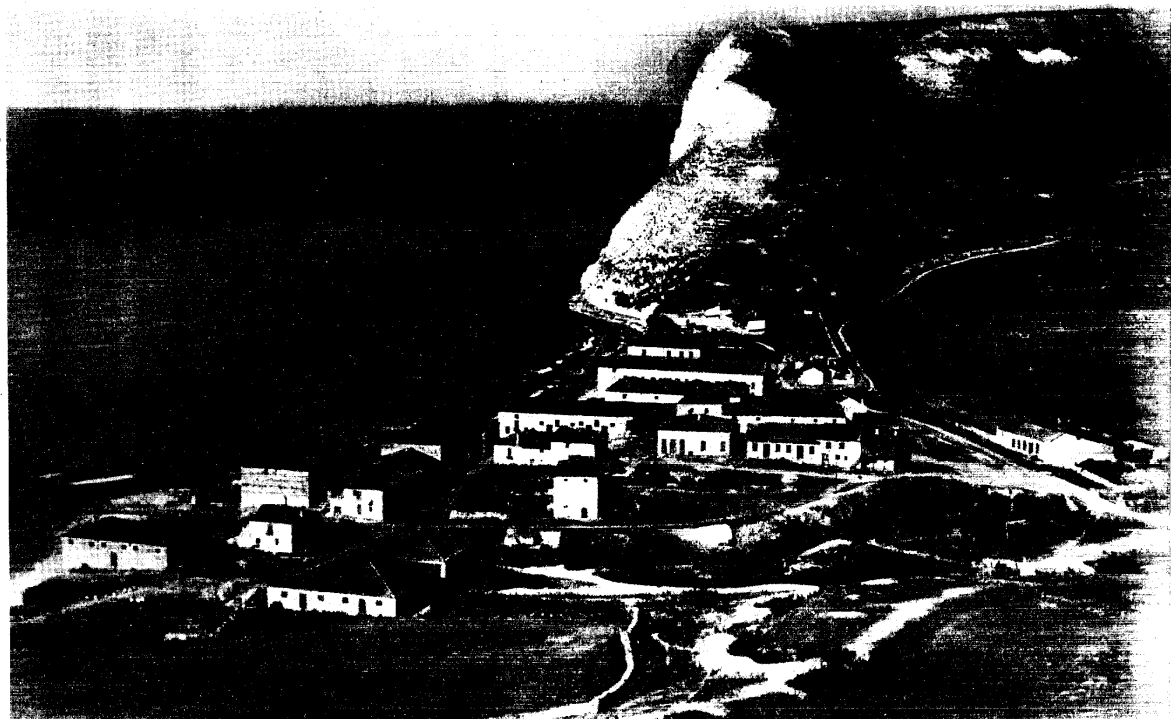
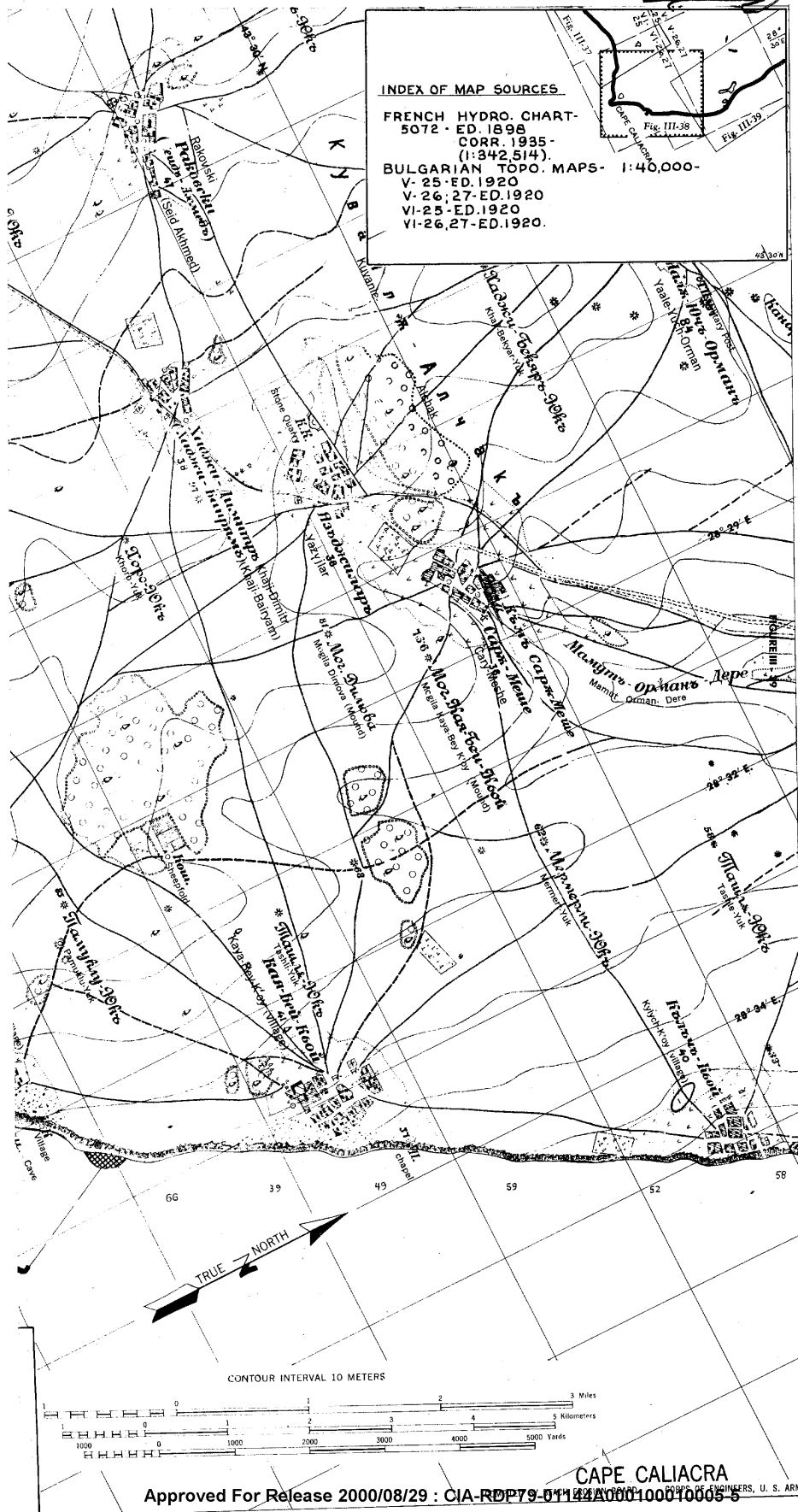
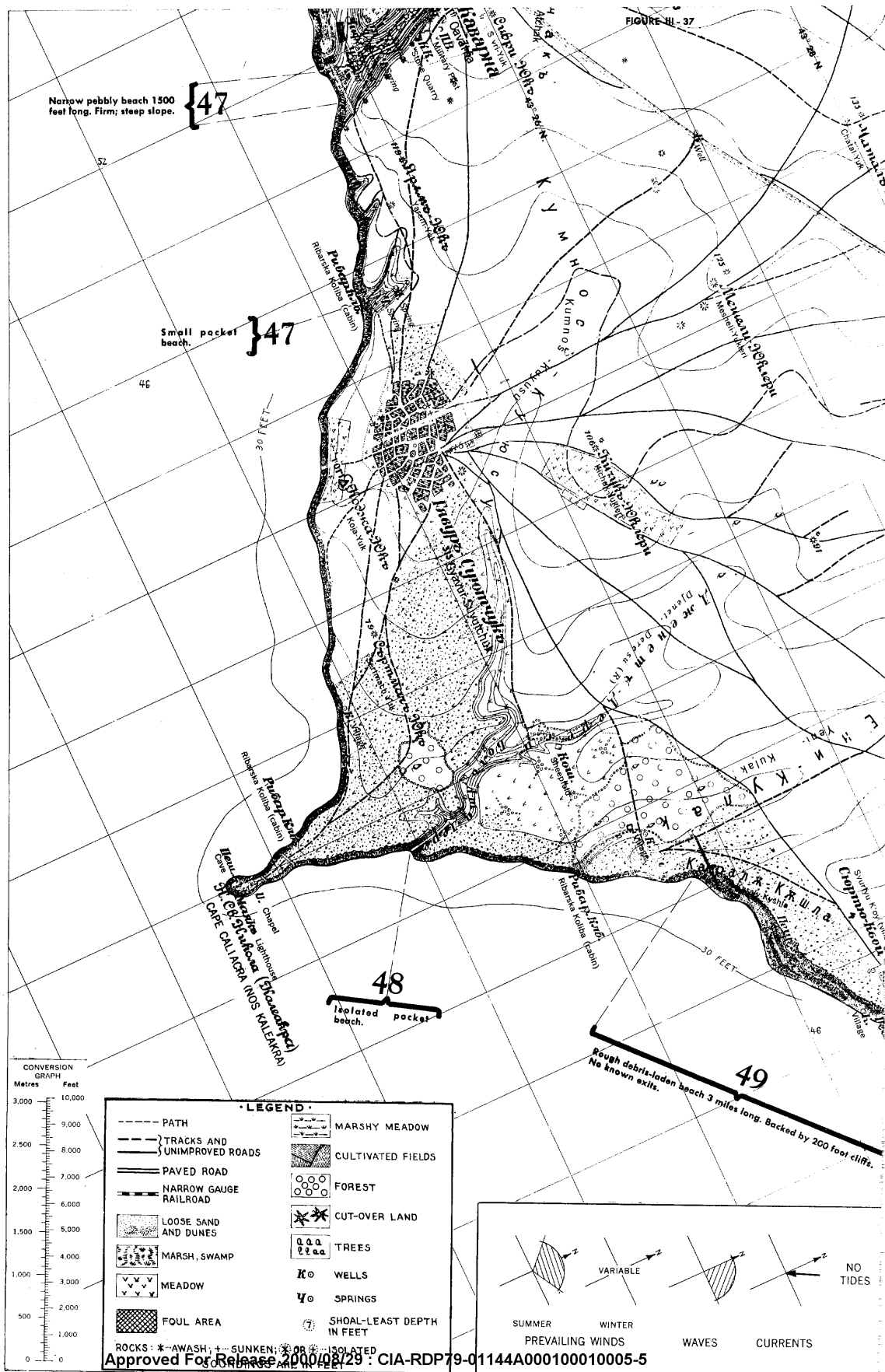


Illustration III - 93. Cavarna.
Looking southwest over the town. Note the three lines of breakers at center.

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The bottom material is probably mud. Information is not available on the location of rock hazards. The shore is unprotected from the winds, which are variable in winter, and



Illustration III - 96. Bol-Ata Dere.

Beach at the mouth of the stream Bol-Ata Dere. Before 1928.

prevailing northerly in summer. Waves approaching from northeast to east break with considerable force. Offshore currents are generally southward. (Figure III - 20.) There are no tides.

(c) *Landing place.* The strip of shore extending for about $2\frac{3}{4}$ miles along the foot of the cliff has a maximum width of 1,000 feet about one mile from its southwest end. The shore is composed chiefly of rough debris fallen from the cliffs back of it. Its most obvious features are several ridges of rock extending lengthwise along it, particularly at its southern end, and in its central part. In the central part a lake is ponded between two rock ridges. (Illustrations III - 97 and III - 98.) The beach surface is very firm, though rough, and slopes are irregular but moderate. The surf is frequently heavy, with but few lines of breakers. No structures are known.

(d) *Terrain inland and on flanks of beach.* The 230-foot cliff backing the beach borders a plateau extending many miles inland. In this area it is unbroken by ravines. No exits are known; access to the interior is apparently impossible.

(50) *Lake Satalmas (Yezero Shablensko).* (Figure III - 39.) Reliability fair.

(a) *Location and extent.* Lake Satalmas is cut off from the sea by a broad sandy barrier beach which is part of a beach



Illustration III - 97. Syurtyu-K'oy.

Limestone rubble at the foot of the cliffs near Syurtyu-K'oy. Heraklea Yezero (lake) shows in the middle distance. Looking southwest. Before 1928.

beginning a short distance north of the lake, and extending nearly four miles southward, fronting also the small lake Tuzlata. It lies between latitude $43^{\circ} 32' 50''$ N, longitude $28^{\circ} 36' 20''$ E, and latitude $43^{\circ} 35' 45''$ N, longitude $28^{\circ} 34' 10''$ E. A lighthouse on Cape Shableh, $\frac{1}{2}$ mile south of the beach, forms a good landmark.

(b) *Nearshore.* The bottom slope off the beach is fairly gentle. Fronting Lake Satalmas the 30-foot depth line lies about $\frac{1}{2}$ mile off the shore, but along the southern part of the beach it is nearly a mile out. The bottom material is mud, changing to sand near shore. In winter the prevailing winds are variable. The beach is entirely unprotected from the prevailing northerly and northeasterly winds of summer. Wave action is heavy, the waves starting to break some distance from the shore. The force of southeasterly storm waves is somewhat broken by Cape Shableh (Şabla) along which the southern part of the beach lies. Offshore currents are generally southerly. There are no tides. Storms from the northeast raise the water level.

(c) *Landing place.* The beach is nearly four miles long and about 300 feet wide. For most of its length it is gently concave in shape, bordering a broad slightly indented bay, but at its



Illustration III - 98. Syurtyu-K'oy.

Looking northeast over Heraklea Yezero (lake). Before 1928.

southern end it becomes slightly convex as it approaches the eastern extremity of Cape Shableh. It has a firm foreshore of moderate slope, and a soft backshore with a gentle slope gradually flattening inland. The surf covers a wide belt with numerous lines of breakers. Shore drift is generally southward. A track or trail runs the whole length of the beach, but there are no known structures on it.

(d) *Terrain inland and on flanks of beach.* The beach borders a broad plain gently sloping upward from the shore. Lake Satalmas is fed by two streams, one from the northwest, one from the southwest, and arms of the lake, which is very shallow, extend upstream in these two directions. The village of Şabla (Shableh, Shabla) lies three miles inland. The beach is directly backed by a narrow belt of wind-blown sand, with perhaps some dunes. A trail runs its entire length northward two miles to the village of Carapcea (Karapcha), and southward $\frac{1}{2}$ mile from the south end of the beach to the Cape Shableh (Şabla) lighthouse, from which a road runs inland to Şabla. There are cultivated gardens and grasslands near Şabla and around Lake Satalmas. The terrain is largely devoted to the cultivation of cereals.

(51) *Carapcea (Karapcha)*. (Figure III - 39.) Reliability fair.

(a) *Location and extent*. About one mile north of the small village of Carapcea is a broad sandy beach about $\frac{1}{2}$ mile long, its center located at about latitude $43^{\circ} 38' 40''$ N, longitude $28^{\circ} 34' 20''$ E.

(b) *Nearshore*. The bottom slope is moderate off the beach; the 30-foot line lies a little less than $\frac{1}{2}$ mile from the shore. The approach to the beach is apparently clear. It is completely exposed to winds from any direction. Southeasterly storms are particularly violent. Waves approach from the east and northeast generally and wave action is moderately heavy. Offshore currents flow southward but are not strong. There are no tides.

(c) *Landing place*. The beach borders a slight indentation of the coast. It is about $\frac{1}{2}$ mile long, uninterrupted. Its width is some 250 to 300 feet maximum. It is composed of sand. The foreshore has a moderate slope and a firm surface. The backshore is soft with a gentle slope, becoming flat inland. The surf covers a wide belt with several lines of breakers. Shore drift is slight and southward. There is a well on the northwestern part of the beach. No structures are known upon it.

(d) *Terrain inland and on flanks of beach*. Low bluffs extend along the shore from either end of the beach. These, with the beach, border a gently sloping plain extending inland. Directly back of the beach is a belt of wind-blown sand, possibly with dunes, about as wide as the beach itself. A track or trail runs close back of this sand belt, southward to the village of Carapcea, and northward along the shore four or five miles until it joins roads running inland and along the coast.

(52) *Răcari (Duran-Kulak)* — A. (Figure III - 39.) Reliability fair.

(a) *Location and extent*. The little village of Răcari lies inland of a lagoon, Lake Cartal (Duran-Kulashko-Blato), which is vaguely L-shaped, one leg extending westward upstream along the Gorenko-Dere, the other leg extending northward along the coast. The lagoon is separated from the sea by a wide sandy barrier beach about $2\frac{1}{4}$ miles long. The beach extends from latitude $43^{\circ} 40' 05''$ N, longitude $28^{\circ} 34' 00''$ E, and extends to latitude $43^{\circ} 42' 00''$ N, longitude $28^{\circ} 34' 20''$ E.

(b) *Nearshore*. The bottom slope is gentle; the 30-foot line lies about one mile off the shore in the northern part of the area, and more than $\frac{1}{2}$ mile from it toward the south. It is composed of mud changing to sand near shore. There are no rock hazards in the approach to the beach. The beach is entirely unprotected from winds from any direction, except that the north end of it may be somewhat shielded from the prevailing northerly winds of summer. Southeast storms cause heavy wave action. Waves generally approach from southeast to east; they break a considerable distance from the shore. Offshore currents are generally southward. There are no tides.

(c) *Landing place*. This barrier beach is $2\frac{1}{4}$ miles long and about 700 feet wide. It extends north and south in a gentle arc along the back of an open bay, and turns north-eastward at its northern end. There are no interruptions to it, although in rainy weather the lagoon back of it probably

has an outlet across it. The foreshore has a moderate slope and is firm; the backshore is soft and has a gentle slope flattening toward the lagoon, and at the edge of the lagoon sloping inland to the foreshore along the lagoon. The surf covers a broad belt with many lines of breakers. Shore drift is slight and northward. There are no structures on the beach. A trail runs along the center the whole length of the beach.

(d) *Terrain inland and on flanks of beach*. Back of the lagoon lies a broad plain sloping gently upward inland. The stream Gorenko Dere is incised in this plain in a shallow ravine-like valley and flows northeastward into the lagoon. Cereals are extensively cultivated. Exit from the beach can be had only at its extremities. At its north end the trail along it turns northwestward and joins a road leading northward along the coast and eastward to the village of Răcari, two miles distant. Southward the trail follows the coast about three miles to the village of Carapcea where there are roads leading in various directions.

(53) *Răcari—B*. (Figure III - 39.) Reliability fair.

(a) *Location and extent*. A sand and pebble beach one mile long lies at the foot of a 50-foot cliff one mile north of the lagoon Lake Cartal and $2\frac{1}{2}$ miles east-northeast of the village of Răcari, its center about at latitude $43^{\circ} 43' 00''$ N, longitude $28^{\circ} 34' 30''$ E.

(b) *Nearshore*. The bottom slope is gentle, the 30-foot depth line lying about one mile offshore. Very little information is available regarding the hydrography in this area. The bottom is probably muddy. The cliffs backing the beach offer some shelter from winds close to shore. The prevailing winds are variable in the winter and from the north and northeast in summer. Waves approach generally from east to northeast and break a considerable distance from the shore. Currents offshore are generally southward. There are no tides.

(c) *Landing place*. The beach is one mile long, with a maximum width of more than 500 feet in its southern part, but generally about half that width. It extends essentially in a straight line without interruptions. It is composed of sand and pebbles. The slope of the foreshore is moderate and its surface is firm. The backshore is somewhat softer and its slope is more gentle. The surf breaks over a broad belt with many lines of breakers. Shore drift is essentially lacking; though strong northeast winds may cause a slight drift to the south. No structures are on the beach.

(d) *Terrain inland and on flanks of beach*. The beach is backed directly and for its whole length by a cliff about 50 feet high. Back of the cliff is a gently sloping plain largely planted to cereal crops. There is no apparent exit from the beach, although at the top of the cliff is a road which runs southwestward $2\frac{1}{2}$ miles to the village of Răcari, and northward about one mile to the Bulgarian-Rumanian border (as claimed in 1942) where it joins a road leading to the Rumanian village of Vama Veche (Ilanlk) one mile northward. However, just beyond the north end of the beach there are three very small ravines cut into the cliff not more than 400 or 500 feet, with trails running from the heads of the two northernmost ones to the road a few hundred feet to the southwest. This suggests that access to the inland up the cliff is possible for men but it is doubtful for vehicles.

